

Stormwater Division

MEMORANDUM

DATE: March 13, 2010
TO: Michael J. Gillis, Virginia Correctional Enterprises Document Management Services
FROM: Jo Anna Ripley, Stormwater
PO: 270712
RE: Files Approved for Scanning

General File ID or BMP ID: PC175

PIN: 3240100026C

**Subdivision, Tract, Business or Owner
Name (if known):**

Williamsburg Plantation and Virginia Department of
Transportation (VDOT)

Property Description:

Williamsburg Plantation Section 5

Site Address:

4870 Longhill Road

(For internal use only)

Box 7

Drawer: 4

Agreements: (in file as of scan date)

N

Book or Doc#:

Page:

Comments

THIS FACILITY IS NOT ACTUALLY ON INDICATED PIN; IT IS ADJACENT TO HUMELSINE PARKWAY EAST (ROUTE 199E) BEHIND INDIAN FIELDS WAY. This project was a joint venture between Williamsburg Plantation and VDOT. VDOT SWMF G. VDOT Proj 0199-047-F30; PE-103; RW-2

PRINTED ON

Tuesday, March 09, 2010

12:18:25 PM

WATERSHED

PC

BMP ID NO

175

PLAN NO

SP-103-00

TAX PARCEL

(32-4)(1-26C)

PIN NO

3240100026C

CONSTRUCTION DATE

7/1/2002

PROJECT NAME

Williamsburg Plantation Sec 5 (VDOT

FACILITY LOCATION

CITY-STATE

Williamsburg, Va. 23185

CURRENT OWNER

Virginia Dept. of Transportation

OWNER ADDRESS

OWNER ADDRESS 2

CITY-STATE-ZIP CODE

OWNER PHONE

MAINT AGREEMENT

Yes

EMERG ACTION PLAN

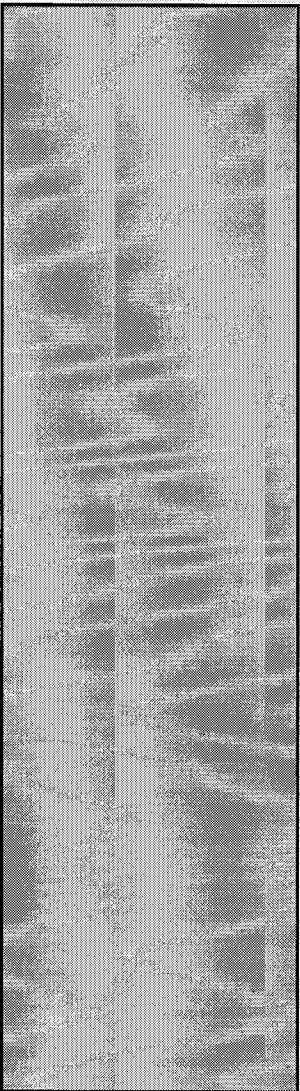
No

Get Last BMP No

Return to Menu

MAINTENANCE PLAN		CTRL STRUC DESC		DI-7 grate
SITE AREA acre	No	CTRL STRUC SIZE inches		
LAND USE	39.53	OTLT BARRL DESC		RCP Barrel
old BMP TYP	R-2 (Appartments)	OTLT BARRL SIZE inch		42
JCC BMP CODE	Dry Pond - SM			
POINT VALUE	F2 Dry ED with forebay			
	9	EMERG SPILLWAY		Yes
		DESIGN HW ELEV		52.90
		PERM POOL ELEV		N/A
SVC DRAIN AREA acres	39.53	2-YR OUTFLOW cfs		29.94
		10-YR OUTFLOW cfs		96.95
		REC DRAWING		Yes
SERVICE AREA DESCRI	Appartments & 4 acre portion of RT 199			
IMPERV AREA acres	13.18	CONSTR CERTIF		Yes
RECV STREAM	UT of Pow Creek			
EXT DET-WQ-CTRL	Yes	LAST INSP DATE	11/16/2004	Inspected by:
WTR QUAL VOL acre-ft	1.09	INTERNAL RATING		3
CHAN PROT CTRL	Yes	MISC/COMMENTS		
CHAN PROT VOL acre-ft				
SW/FLOOD CONTROL	Yes			VDOT SWMF G, VDOT Proj 0199-047-F30, PE-103, RW-204, C-501, Shared facility.
GEOTECH REPORT	Yes			

Additional Comments:

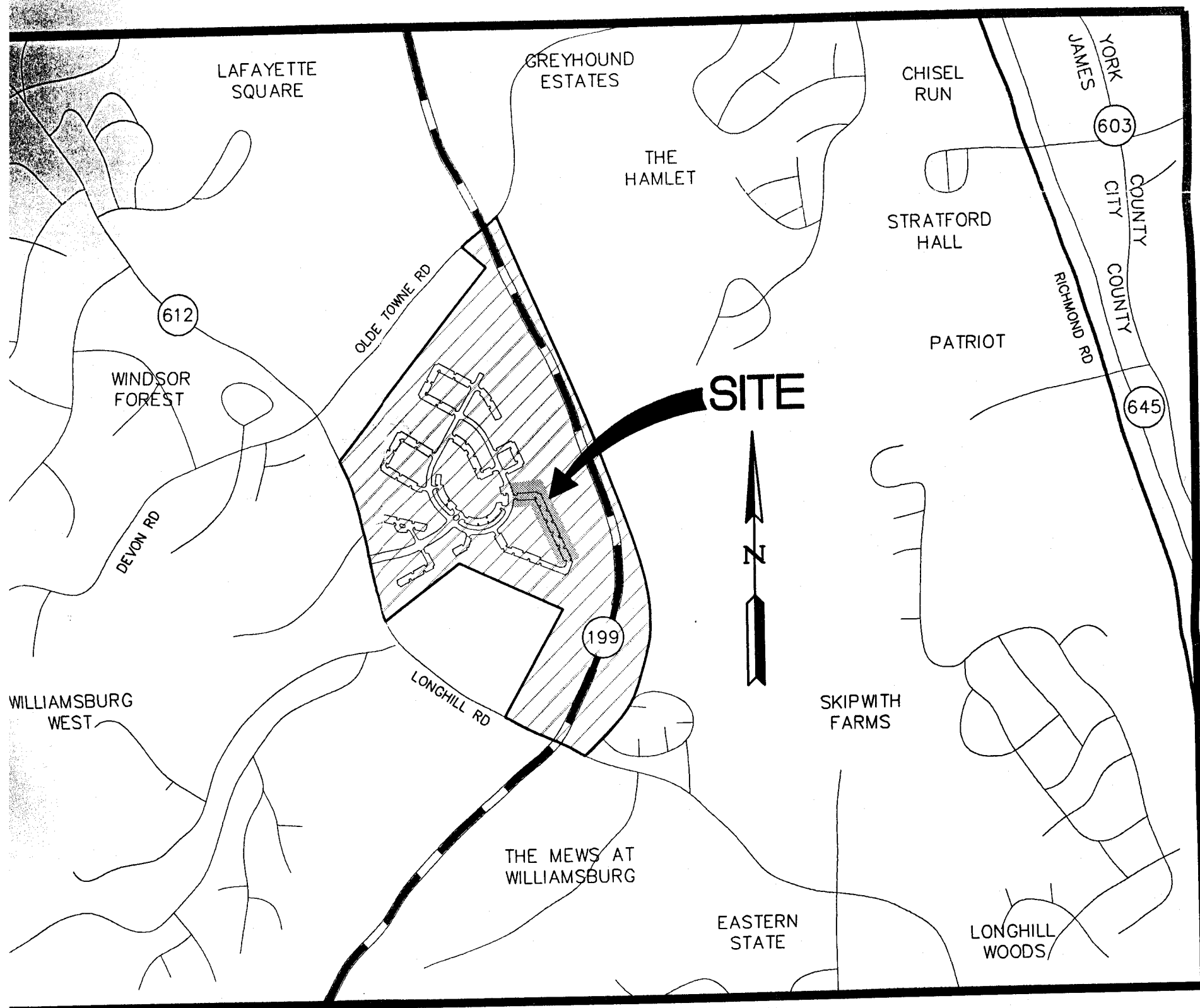


BURG PLANTATION

5: UNITS 97-1

FOR

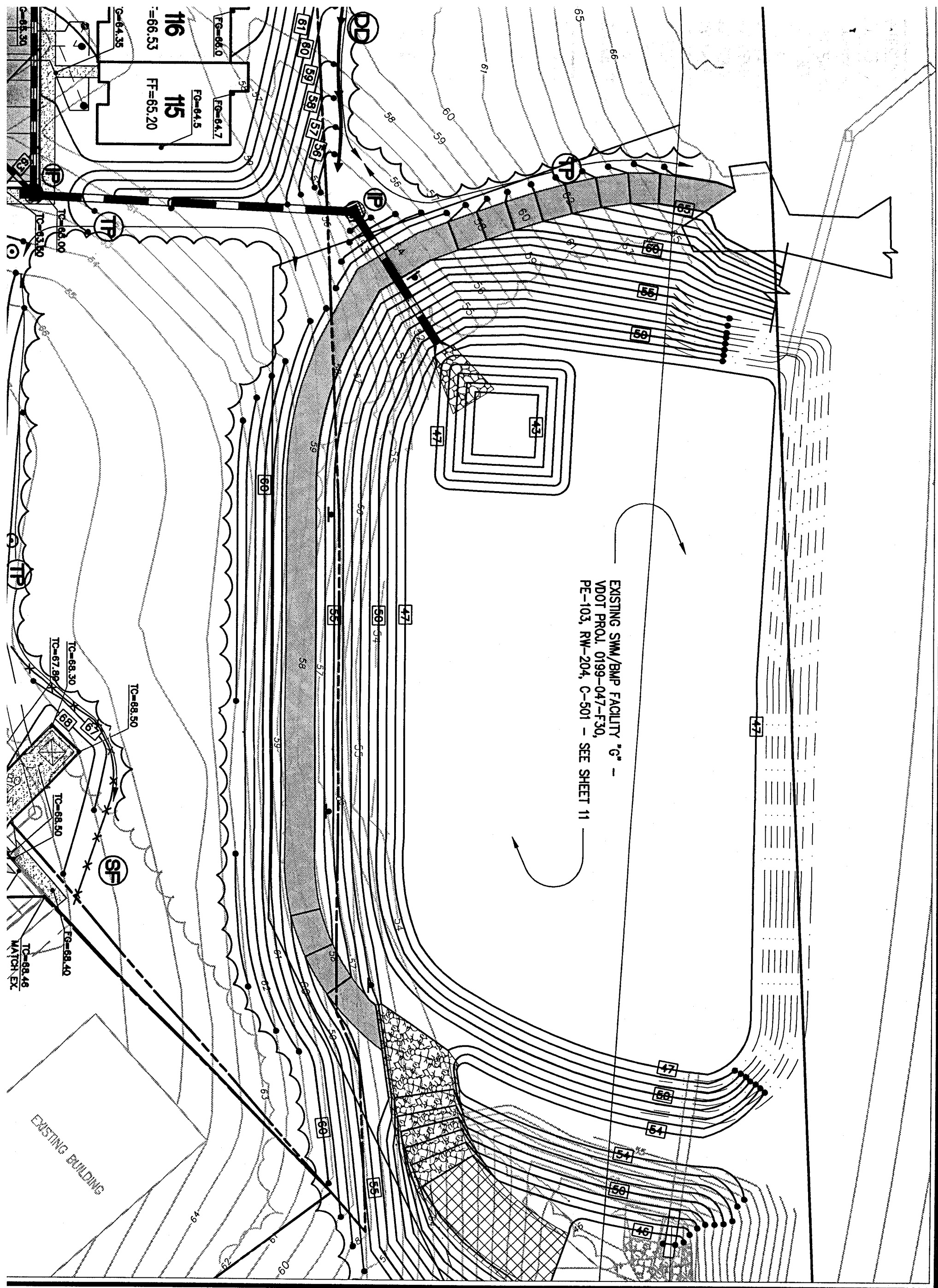
BURG PLANTATION, INC



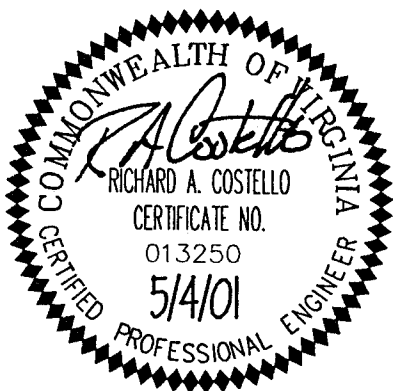
VICINITY MAP (APPROX. SCALE 1"=1000')

DATE: AUGUST 23, 2000
REVISED: NOVEMBER 16, 2000
PROJECT NO.: 7555-12





Road, Suite 1
inia 23188
040
)-8994



No.	DATE	REVISION / COMMENT / NOTE	BY
5	5/4/01	REVISED PER JCSA COMMENTS DATED 5/1/01	CBR
4	4/17/01	REVISED PER JCC ENVIR. COMMENTS AND TO INDICATE PHASING	CBR
3	3/23/01	REVISED PER VDOT COMMENTS (DRY POND) FACILITY "G"	CBR
2	11/16/00	REVISED PER JCSA COMMENTS	CBR
1	10/18/00	REVISED SITE LAYOUT & REVISIONS PER JCC COMMENTS	CBR

NBL RTE. 199

SBL RTE. 199

EX. POND SLOPE

-EX. TOE OF SLOPE

EX. TOP OF
DAM = 56.0 ±

EX. D.I. OUTLET STRUCTURE
EX. TOP = 49.33
EX. 4" OFFICE INV. = 47.00 (PLUGGED)
EX. INV. OUT = 44.14

129.00'

SF
OF INI

EX 45 RCP
INV. = 143.95

(TO REMAIN)

VDOT LIMITED
ACCESS LINE

NEW STORMWATER MANAGEMENT POND _____
CONSTRUCTION AND MAINTENANCE EASEMENT
FOR FACILITY "G" - VDOT PROJ.
0199-047-F30, PE-103, RW-204, C-501

-EX. TOP OF SLOPE

DIVERSION DITCH

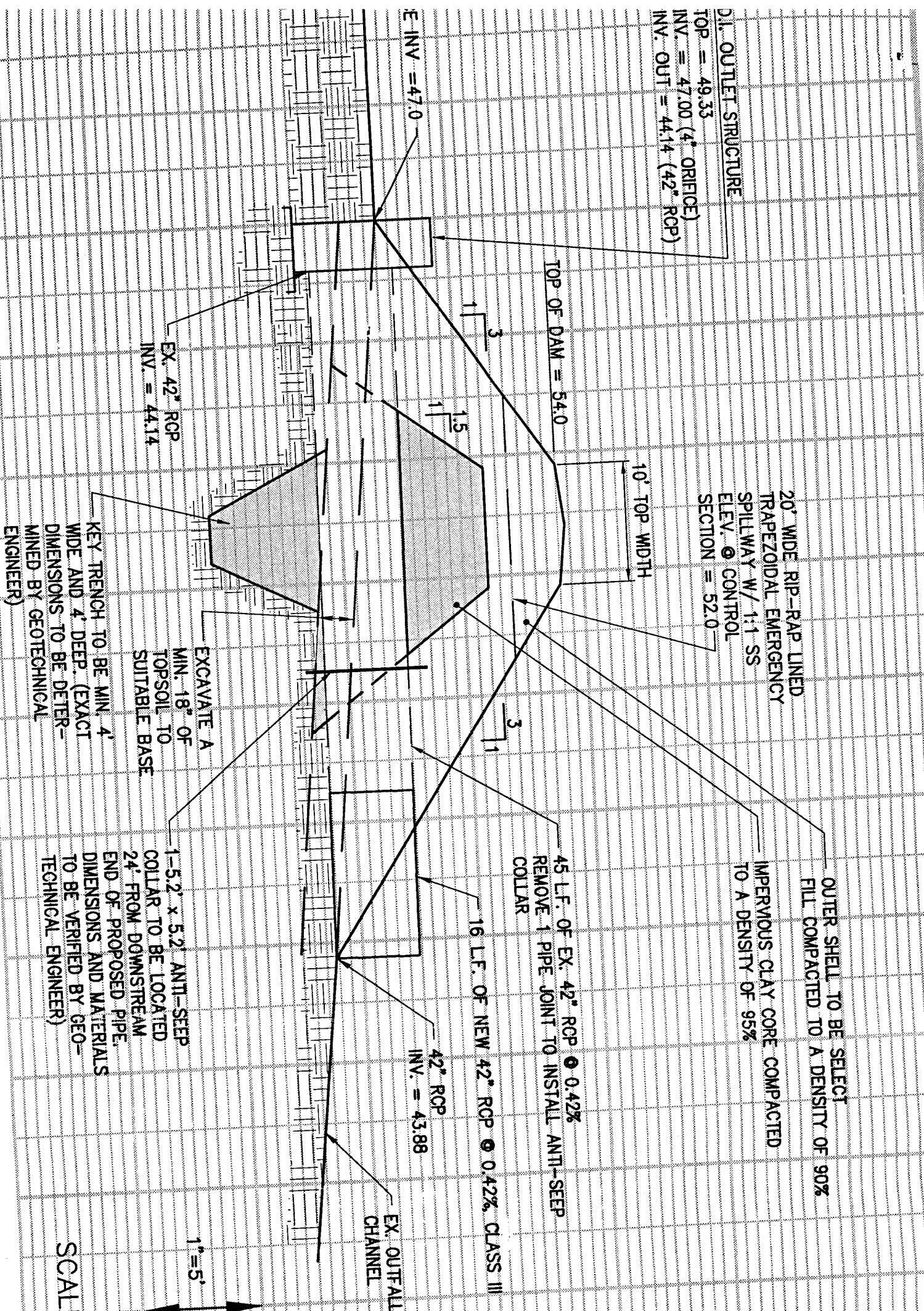
10' WIDE
MAINTENANCE
ACCESS ROADWAY
"NO TRESPASSING"
SIGN (TYP.)

~~"NO TRESPASSING"~~
~~SIGN (TYP.)~~ —

35-LC

CLEAR!

20" WIDE RIP-RAP LINED
TRAPAZOIDAL EMERGENCY
SPILLWAY SECTION WITH 1:1
ELEV. @ CONTROL SECTION =



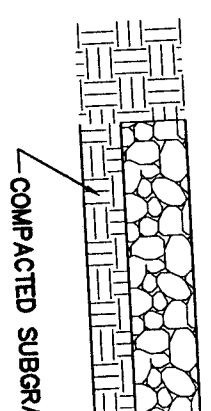
CROSS SECTION A-A THROUGH OUTLET STRUCTURE

65
60
55
50
45
40
35
30

1. A GEOTECHNICAL SUBSURFACE EXPLORATION AT THE PROPOSED DENSITY OF THE SUBGRADE. THE GEOTECHNICAL INVESTIGATION WILL RECOMMEND ANTI-SEEP MEASURES, KEY TRENCH DEPTH AND WIDTH PHREATIC LINE. THESE RECOMMENDATIONS ARE HEREBY MADE A PART OF THE CONTRACT. THE GEOTECHNICAL CONSULTANT SHALL BE RESPONSIBLE FOR THE PROPER MATERIALS AND DAM CONSTRUCTION METHODS ARE UTILIZED. THE DAM WAS BUILT IN ACCORDANCE WITH THE DESIGN ENGINEER IN ORIGIN. THE CONSULTANT SHALL COORDINATE WITH THE DESIGN ENGINEER IN ORIGIN. THE CONSULTANT SHALL BE RESPONSIBLE FOR COORDINATING THE DAM CONSTRUCTION IN ORDER TO ENSURE ON-SITE MONITORING.

2. SITE PREPARATION: THE CONTRACTOR SHALL STRIP ALL AREAS OF THE PERMANENT CONSTRUCTION. THE UNSUITABLE MATERIALS TO BE REMOVED, INCLUDING STUMPS AND ROOTS, DEBRIS AND VEGETABLE MATTER, INCLUDING STUMPS AND ROOTS, UNSUITABLE FOR USE IN THE PERMANENT CONSTRUCTION.

3. EMBANKMENT: THE EXPOSED SUB GRADE SOILS SHALL BE CAREFULLY INSPECTED AND THE EXPOSED SUB GRADE SOILS SHALL BE REMOVED AND REPLACED WITH SUITABLE MATERIALS. THE UNSUITABLE MATERIALS TO BE REMOVED, INCLUDING STUMPS AND ROOTS, DEBRIS AND VEGETABLE MATTER, INCLUDING STUMPS AND ROOTS, UNSUITABLE FOR USE IN THE PERMANENT CONSTRUCTION.



MAINTENANCE AND REPAIR

AES CONSULTING ENGINEERS
Engineering, Surveying, and Planning
5248 Olde Towne Road, Suite 1
WILLIAMSBURG, VIRGINIA 23188

Phone: (757) 253-0040

Fax: (757) 220-8994

LETTER OF TRANSMITTAL



ATTN: **Scott Thomas, P.E.**

CO.: JCC Enviromental Division

Address:

cc:

DATE

3/27/03

JOB NO.

7555-12

FROM:

Bruce Abbott

RE

Williamsburg Plantation Section 5
SMP (VDOT Facility "G")

SP-103-DU PC 175

WE ARE SENDING YOU THE FOLLOWING ITEMS:

☒ Attached

☐ Under separate cover via

☐ Original(s) ☒ Print(s)

☐ Plan(s)

☐ Specification(s)

☐ Change Order

☐ Copy of letter(s)

☒ Other: Construction Certification

COPIES	DATE	No. of Pages	DESCRIPTION
1		8	Construction Certification
1		2	Record Drawings

THESE ARE TRANSMITTED as checked below:

☒ For your approval

☐ For your signature

☐ For review and comment

☐ For your use

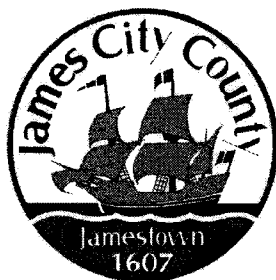
☐ As you requested

☐ As requested by:

☐ Other:

REMARKS:

If enclosures are not as noted, kindly notify us at once.



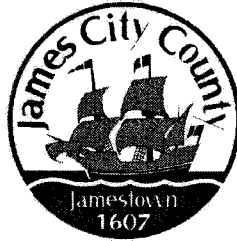
**James City County, Virginia
Environmental Division**

**Stormwater Management / BMP Facilities
Record Drawing and Construction Certification**

Standard Forms & Instructions

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*Issue Date
February 1, 2001*



James City County, Virginia
Environmental Division

Stormwater Management / BMP Facilities
Record Drawing and Construction Certification Forms

(Note: In accordance with the requirements of the Chesapeake Bay Preservation Ordinance, Chapter 23, Section 23-10(4), BMP's shall be designed and constructed in accordance with the manual entitled James City County Guidelines for Design and Construction of Stormwater Management BMP's. Erosion and sediment control policy and approved plans generally require that at the completion of the project and prior to release of surety, an "as-built" plan prepared by a registered Professional Engineer or Certified Land Surveyor must be provided for the drainage system for the project, including any Best Management Practice (BMP) facilities. In addition, for BMP facilities involving the construction of an impounding structure or dam embankment, certification is required by a Professional Engineer who has inspected the structure during its construction. Currently there are over 20 water quality type BMP's accepted by the County.)

Section 1 – Site Information:

Project Name: Williamsburg Plantation Section 5
Structure/BMP Name: SMP (VDOT Facility "G")
Project Location: 4370 Longhill Road
BMP Location: Between Indian Fields Way & Route 199
County Plan No.: SP - 103 - 00

Project Type: ☒ Residential ☐ Business Tax Map/Parcel No.: (32-4)(I-266)
☐ Commercial ☐ Office BMP ID Code (if known):
☐ Institutional ☐ Industrial Zoning District: Limited Residential R-2
☐ Public ☐ Roadway Land Use:
☐ Other Site Area (sf or acres): 1.5 +/- Ac.

Brief Description of Stormwater Management/BMP Facility: Upgrade of existing VDOT BMP to include drainage from southeast area of Williamsburg Plantation.

Nearest Visible Landmark to SWM/BMP Facility: RTE. 199

Nearest Vertical Ground Control (if known):
☐ JCC Geodetic Ground Control ☐ USGS ☐ Temporary ☐ Arbitrary ☒ Other
Station Number or Name:
Datum or Reference Elevation: 49.33
Control Description: Top of the Outlet Structure
Control Location from Subject Facility: _____

Section 2 – Stormwater Management / BMP Facility Construction Information:

PreConstruction Meeting Held for Construction of SWM/BMP Facility: ☒ Yes ☐ No ☐ Unknown
Approx. Construction Start Date for SWM/BMP Facility: January, 2002
Facility Monitored by County Representative during Construction: ☒ Yes ☐ No ☐ Unknown
Name of Site Work Contractor Who Constructed Facility: George Nice & Sons
Name of Professional Firm Who Routinely Monitored Construction: FES
Date of Completion for SWM/BMP Facility: May, 2002
Date of Record Drawing/Construction Certification Submittal: _____

(Note: Record Drawing and Construction Certifications are required within thirty (30) days of the completion of Stormwater Management and/or BMP facility construction. Record Drawings and Construction Certifications must be reviewed and approved by the James City County Environmental Division prior to final inspection, acceptance and bond or surety release.)

Section 3 – Owner / Designer / Contractor Information:

Owner/Developer: *(Note: Site Owner or Applicant responsible for development of the project.)*

Name: Virginia Department of Transportation
Mailing Address: Williamsburg Residency
4451 Ironbound Road, Williamsburg, Virginia 23185
Business Phone: (757)253-4832 Fax: (757)253-5148
Contact Person: Jim Brewer Title: _____

Design Professional: *(Note: Professional Engineer or Certified Land Surveyor responsible for the design and preparation of plans and specifications for the Stormwater Management / BMP facility.)*

Firm Name: AES
Mailing Address: 5248 Olde Towne Road
Williamsburg, VA 23188
Business Phone: (757) 253-0040
Fax: (757) 220-8994
Responsible Plan Preparer: Charles Records
Title: Project Engineer
Plan Name: Williamsburg Plantation Sections
Firm's Project No. 7555-12
Plan Date: 8/23/00 Rev. 10/16/00
Sheet No.'s Applicable to SWM/BMP Facility: 1 / 11 / _____ / _____ / _____

BMP Contractor: *(Note: Site Work Contractor directly responsible for construction of the Stormwater Management / BMP facility.)*

Name: George Nice & Sons
Mailing Address: 143 Skimino Road
Williamsburg, VA 23188
Business Phone: (757) 565-2885
Fax: (757) 565-1526
Contact Person: Ray Nice
Site Foreman/Supervisor: _____
Specialty Subcontractors & Purpose (for BMP Construction Only):

Section 4 – Professional Certifications:

Certifying Professionals: *(Note: A Registered Professional Engineer or Certified Land Surveyor is responsible for preparation of a Record Drawing, sometimes referred to as an As-Built plan, for the drainage system for the project including any Stormwater Management/BMP Facilities. A Registered Professional Engineer is responsible for the inspection, monitoring and certification of Stormwater Management / BMP facilities during its construction.)*

Record Drawing and Construction Certifications for Stormwater Management / BMP Facilities

Record Drawing Certification

Firm Name: AES
Mailing Address: 5248 Olde Towne Road
Williamsburg, VA 23188
Business Phone: (757) 253-0040
Fax: (757) 220-8994

Name: Richard A. Costello, P. E.
Title: President

Signature: _____
Date: _____

I hereby certify to the best of my knowledge and belief that this record drawing represents the actual condition of the Stormwater Management / BMP facility. The facility appears to conform with the provisions of the approved design plan, specifications and stormwater management plan, except as specifically noted.

Construction Certification

Firm Name: _____
Mailing Address: _____
Business Phone: _____
Fax: _____

Name: _____
Title: _____

Signature: _____
Date: _____

I hereby certify to the best of my knowledge and belief that this record drawing represents the actual condition of the Stormwater Management / BMP facility. The facility appears to conform with the provisions of the approved design plan, specifications and stormwater management plan, except as specifically noted.

PREVIOUSLY SUBMITTED



(Seal)

Virginia Registered Professional Engineer
Or Certified Land Surveyor

(Seal)

Virginia Registered
Professional Engineer

STORMWATER MANAGEMENT / BMP FACILITIES RECORD DRAWING CHECKLIST

(Key for Checklist is as follows: XX Acceptable N/A Not Applicable Inc Incomplete)

I. Methods and Presentation: *(Required for all Stormwater Management / BMP facilities.)*

- XX 1. All constructed facilities meet approved design plans, unless otherwise shown. Record information or deviations from approved design plan shown in clearly annotated format and/or boxed beside design values.
- XX 2. Elevations to the nearest 0.1' unless higher accuracy is needed to show positive drainage.
- XX 3. All plan sheets labeled with "RECORD DRAWING" in large text in lower right hand corner (Approved County Plan Number and BMP ID Code can be included if known).
- XX 4. All plans sheet revision blocks modified to indicate date and record drawing status.
- XX 5. All plan sheets have certification statements and certifying professional's signature and seal.

II. Minimum Standards: *(Required for all Stormwater Management / BMP facilities, as applicable.)*

- XX 1. All requirements of Section I (Methods and Presentation) apply to this section.
- XX 2. Plan Views: Show general location, arrangement and dimensions. Location and alignment shall generally match approved design plans.
- XX 3. Profile or elevations along top or berm of the facility. At a minimum, elevations are required at each end, at intervals not to exceed 50 feet and where low spots may be present. Top of embankment or berm elevations must be no less than design elevation plus any settlement allowances.
- XX 4. Top widths, berm widths and embankment side slopes.
- XX 5. Show length, width and depth of facility or grading, contours or spot elevations as required to verify permanent pool and design storage volumes were met or were reasonably close to the approved design. Evaluation of as-built grading, contours, spot elevations, or cross-sections, may be necessary by the professional to ensure approved design configurations, depths and volumes were closely maintained. If grading or elevations are significantly different from the approved plan, the Environmental Division shall be contacted immediately to determine whether the variation is acceptable or whether further evidence will be required. Facilities which do not closely resemble approved plan grades, elevations or configurations may require regrading by the Contractor; check volumetric computations; and/or a check hydraulic routing to ensure approved design water surface elevations, discharges or freeboard were closely maintained.
- XX 6. Cross-section of the embankment through the principal spillway or outlet barrel. Must extend at least 100 ft. downstream of the pipe outlet or to recorded site property line, whichever is closer. Proper correlation is required between principal spillway (control structure) crest, emergency spillway crest, orifice and weirs and the top of the dam or facility. All elevations and dimensions must reasonably match the design plan or be sequentially relative to each other and the facility must reflect the required design storage volume(s) and/or design depth.
- XX 7. Profile or elevations along the entire centerline of the emergency spillway. Emergency spillway may be steeper, but no flatter or narrower than design.
- XX 8. Elevation of the principal spillway crest or outlet crest of the structure.

- | | | |
|------------|-----|---|
| <u>XX</u> | 9. | Primary control structure (riser) diameter or dimensions, height, type of material and base size. Indicate provisions for access that are present such as steps, ladders, etc. |
| <u>XX</u> | 10. | Dimensions, locations and elevations of outlet orifices, weirs, slots and drains. |
| <u>N/A</u> | 11. | Type and size of anti-vortex and trash rack device. Height, diameter, dimensions, bar spacings (if applicable) and elevations relative to the principal spillway crest. Indicate if lockable hatch is present or not. |
| <u>XX</u> | 12. | Type, location, size and number of anti-seep collars or documentation of other methods utilized for seepage control. May need to obtain this information during construction. |
| <u>XX</u> | 13. | Top of impervious core embankment, core trench limits and elevation of cut-off trench bottom. May need to obtain this information during construction. |
| <u>XX</u> | 14. | Elevation of the principal spillway barrel (outlet pipe) inlet and outlet invert. |
| <u>XX</u> | 15. | Outlet barrel diameter, length, slope, type and thickness class of material and type of flared end sections, headwall or endwall. |
| <u>XX</u> | 16. | Outfall protection dimension, type and depth of rock and if underlain filter fabric is present. |
| <u>N/A</u> | 17. | BMP interior and periphery landscaping zones conform with arrangements and requirements of the approved design plan. |
| <u>N/A</u> | 18. | Maintenance plan taken from approved design plan transposed onto record drawing set. |
| <u>N/A</u> | 19. | Fencing location and type, if applicable to facility. |
| <u>XX</u> | 20. | BMP vicinity properly cleaned of stockpiles and construction debris. |
| <u>XX</u> | 21. | No visual signs of erosion or channel degradation immediately downstream of facility. |
| <u>XX</u> | 22. | Any other information formally requested by the Environmental Division specific to the constructed SWM/BMP facility. |

STORMWATER MANAGEMENT / BMP FACILITIES RECORD DRAWING CHECKLIST

(Key for Checklist is as follows: XX Acceptable N/A Not Applicable Inc Incomplete)

VIII. Group F – Extended Dry Detention *(Includes F-1 Timber Walls; and F-2 Dry Extended Detention with Forebay)*

- | | | |
|------------|------|---|
| <u>XX</u> | F1. | All requirements of Section II, Minimum Standards, apply to Group F facilities. |
| <u>XX</u> | F2. | Basin bottom has positive slope and drainage from all basin inflow points to the riser (or outflow) location. |
| <u>N/A</u> | F3. | Timber wall BMP used in intermittent stream only. (ie. Prohibited in perennial streams.) |
| <u>Inc</u> | F4. | Forebay provided approximately 20 ft. upstream of the facility. Forebays generally 4 to 6 feet in depth. |
| <u>N/A</u> | F5. | A reverse slope pipe, vertical stand pipe or mini-barrel and riser was provided to prevent clogging |
| <u>XX</u> | F6. | Principal spillway and outlet barrel provided consisting of reinforced concrete pipe with O-Ring gaskets for watertight joint construction. |
| <u>N/A</u> | F7. | Mini-barrel and riser, if used, contains a removable trash rack to reduce clogging. |
| <u>XX</u> | F8. | Low flow orifice, if used, has a minimum diameter of three (3) inches or two (2) inches if internal orifice control was utilized and a small, cage type external trash rack. |
| <u>N/A</u> | F9. | Timbers properly reinforced or concrete footing provided if soil conditions were prohibitive. |
| <u>N/A</u> | F10. | Timber wall cross members extended to a minimum depth of two (2) feet below ground elevation. |
| <u>N/A</u> | F11. | Protection against erosion and scour from the low flow orifice and weir-flow trajectory provided. |
| <u>XX</u> | F12. | Stilling basin or standard outlet protection provided at principal spillway outlet. |
| <u>XX</u> | F13. | Adequate, direct access provided to the facility. Access corridor to facility is at least ten (10) feet wide, slope is less than twenty (20) percent and appropriate stabilization provided for equipment and vehicle use. Access extends to forebay, standpipe and timber wall, as applicable. |
| <u>N/A</u> | F14. | No visual signs of undercutting of timber walls or clogging of the low orifice were present. |
| <u>XX</u> | F15. | No visual signs of erosion or channel degradation immediately downstream of facility. |
| <u>XX</u> | F16. | No visible signs of accumulated silt/sediment were present in the facility following construction or alternately, accumulated silt/sediment was properly removed and no adverse affects to the function of the facility are anticipated. |

CURRENTLY FUNCTIONING AS A SEDIMENT BASIN.

STORMWATER MANAGEMENT / BMP FACILITIES RECORD DRAWING CHECKLIST

(Key for Checklist is as follows: XX Acceptable N/A Not Applicable Inc Incomplete)

X. Storm Drainage Systems (Associated with BMP's Only)

(Includes all incidental stormwater drainage conveyance systems associated with SWM/BMP facilities such as onsite or offsite storm drains, open channels, inlets, manholes, junctions, outlet protections, deflectors, etc. These facilities are external to the treatment function of, but are directly associated with drainage to and/or from a constructed SWM/BMP facility. The intent of this portion of the certification is to accurately identify the type and quantity of inflow or outflow points associated with the facility for future reference. The Professional may use his/her own discretion to determine inclusive facilities to meet the intent of this section. As a general rule, storm drainage systems would include incidental facilities to the nearest access structure upslope or downslope from the normal physical limits of the facility or 800 feet of storm drainage conveyance system length, whichever is less.)

- XX SD1. All requirements of Section II, Minimum Standards, apply to Storm Drainage Systems.
- XX SD2. Horizontal location of all pipe and structures relative to the SWM/BMP facility.
- XX SD3. Type, top elevation and invert elevation of all access type structures (inlets, manholes, etc.).
- XX SD4. Material type, size or diameter, class, invert elevations, lengths and slopes for all pipe segments.
- XX SD5. Class, length, width and depth of riprap and outlet protections or dimensions of special energy dissipation structures.

XII. Other Systems

(Includes any non-typical, specialty, manufactured or innovative stormwater management/BMP practices or systems generally accepted for use as or in conjunction with other acceptable stormwater management / BMP practices. Requires evidence of prior satisfactory industry use and prior Environmental Division approval, waiver or exception.)

- N/A O1. All requirements of Section II, Minimum Standards, apply to this section.
- N/A O2. Certification criteria to be determined on a case-by-case basis by the Environmental Division specific to the proposed SWM/BMP facility.

AES CONSULTING ENGINEERS
Engineering, Surveying, and Planning
5248 Olde Towne Road, Suite 1
WILLIAMSBURG, VIRGINIA 23188

Phone: (757) 253-0040

Fax: (757) 220-8994

LETTER OF TRANSMITTAL

ATTN: **Scott Thomas, P.E.**

CO.: **JCC Enviromental Division**

Address:

cc:

DATE 3/27/03	JOB NO. 7555-12
FROM: Bruce Abbott	
RE Williamsburg Plantation Section 5 SMP (VDOT Facility "G")	

WE ARE SENDING YOU THE FOLLOWING ITEMS:

☒ Attached

☐ Under separate cover via

☐ Original(s) ☒ Print(s)

☐ Plan(s)

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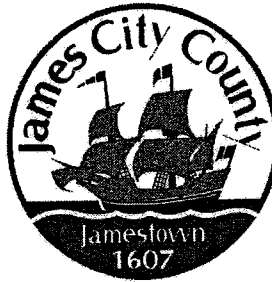
☐ As you requested

☐ As requested by:

☐ Other:

REMARKS:

If enclosures are not as noted, kindly notify us at once.



**James City County, Virginia
Environmental Division**

**Stormwater Management / BMP Facilities
Record Drawing and Construction Certification**

Standard Forms & Instructions

Contents

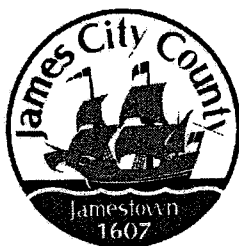
Record Drawing and Construction Certification Forms

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Record Drawing Checklist

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*Issue Date
February 1, 2001*



James City County, Virginia
Environmental Division

Stormwater Management / BMP Facilities
Record Drawing and Construction Certification Forms

(Note: In accordance with the requirements of the Chesapeake Bay Preservation Ordinance, Chapter 23, Section 23-10(4), BMP's shall be designed and constructed in accordance with the manual entitled James City County Guidelines for Design and Construction of Stormwater Management BMP's. Erosion and sediment control policy and approved plans generally require that at the completion of the project and prior to release of surety, an "as-built" plan prepared by a registered Professional Engineer or Certified Land Surveyor must be provided for the drainage system for the project, including any Best Management Practice (BMP) facilities. In addition, for BMP facilities involving the construction of an impounding structure or dam embankment, certification is required by a Professional Engineer who has inspected the structure during its construction. Currently there are over 20 water quality type BMP's accepted by the County.)

Section 1 – Site Information:

Project Name: Williamsburg Plantation Section 5
Structure/BMP Name: SMP (VDOT Facility "G")
Project Location: 4370 Longhill Road
BMP Location: Between Indian Fields Way & Route 199
County Plan No.: SP - 103 - 00

Project Type: ☒ Residential ☐ Business Tax Map/Parcel No.: (32-4)(I-266)
☐ Commercial ☐ Office BMP ID Code (if known):
☐ Institutional ☐ Industrial Zoning District: Limited Residential R-2
☐ Public ☐ Roadway Land Use:
☐ Other Site Area (sf or acres): 1.5 +/- Ac.

Brief Description of Stormwater Management/BMP Facility: Upgrade of existing VDOT BMP to include drainage from southeast area of Williamsburg Plantation.

Nearest Visible Landmark to SWM/BMP Facility: RTE. 199

Nearest Vertical Ground Control (if known):
☐ JCC Geodetic Ground Control ☐ USGS ☐ Temporary ☐ Arbitrary ☒ Other
Station Number or Name:
Datum or Reference Elevation: 49.33
Control Description: Top of the Outlet Structure
Control Location from Subject Facility: _____

Section 2 – Stormwater Management / BMP Facility Construction Information:

PreConstruction Meeting Held for Construction of SWM/BMP Facility: ☒ Yes ☐ No ☐ Unknown
Approx. Construction Start Date for SWM/BMP Facility: January, 2002
Facility Monitored by County Representative during Construction: ☒ Yes ☐ No ☐ Unknown
Name of Site Work Contractor Who Constructed Facility: George Nice & Sons
Name of Professional Firm Who Routinely Monitored Construction: FES
Date of Completion for SWM/BMP Facility: May, 2002
Date of Record Drawing/Construction Certification Submittal: _____

(Note: Record Drawing and Construction Certifications are required within thirty (30) days of the completion of Stormwater Management and/or BMP facility construction. Record Drawings and Construction Certifications must be reviewed and approved by the James City County Environmental Division prior to final inspection, acceptance and bond or surety release.)

Section 3 – Owner / Designer / Contractor Information:

Owner/Developer: *(Note: Site Owner or Applicant responsible for development of the project.)*

Name: Virginia Department of Transportation
Mailing Address: Williamsburg Residency
4451 Ironbound Road, Williamsburg, Virginia 23185
Business Phone: (757)253-4832 Fax: (757)253-5148
Contact Person: Jim Brewer Title: _____

Design Professional: *(Note: Professional Engineer or Certified Land Surveyor responsible for the design and preparation of plans and specifications for the Stormwater Management / BMP facility.)*

Firm Name: AES
Mailing Address: 5248 Olde Towne Road
Williamsburg, VA 23188
Business Phone: (757) 253-0040
Fax: (757) 220-8994
Responsible Plan Preparer: Charles Records
Title: Project Engineer
Plan Name: Williamsburg Plantation Sections
Firm's Project No. 7555-12
Plan Date: 8/23/00 Rev. 10/16/00
Sheet No.'s Applicable to SWM/BMP Facility: 1 / 11 / _____ / _____ / _____

BMP Contractor: *(Note: Site Work Contractor directly responsible for construction of the Stormwater Management / BMP facility.)*

Name: George Nice & Sons
Mailing Address: 143 Skimino Road
Williamsburg, VA 23188
Business Phone: (757) 565-2885
Fax: (757) 565-1526
Contact Person: Ray Nice
Site Foreman/Supervisor: _____
Specialty Subcontractors & Purpose (for BMP Construction Only):

Section 4 – Professional Certifications:

Certifying Professionals: *(Note: A Registered Professional Engineer or Certified Land Surveyor is responsible for preparation of a Record Drawing, sometimes referred to as an As-Built plan, for the drainage system for the project including any Stormwater Management/BMP Facilities. A Registered Professional Engineer is responsible for the inspection, monitoring and certification of Stormwater Management / BMP facilities during its construction.)*

Record Drawing and Construction Certifications for Stormwater Management / BMP Facilities

Record Drawing Certification

Firm Name: AES
Mailing Address: 5248 Olde Towne Road
Williamsburg, VA 23188
Business Phone: (757) 253-0040
Fax: (757) 220-8994

Name: Richard A. Costello, P. E.
Title: President

Signature: _____
Date: _____

I hereby certify to the best of my knowledge and belief that this record drawing represents the actual condition of the Stormwater Management / BMP facility. The facility appears to conform with the provisions of the approved design plan, specifications and stormwater management plan, except as specifically noted.

Construction Certification

Firm Name: _____
Mailing Address: _____
Business Phone: _____
Fax: _____

Name: _____
Title: _____

Signature: _____
Date: _____

I hereby certify to the best of my knowledge and belief that this record drawing represents the actual condition of the Stormwater Management / BMP facility. The facility appears to conform with the provisions of the approved design plan, specifications and stormwater management plan, except as specifically noted.

PREVIOUSLY SUBMITTED



(Seal)

Virginia Registered Professional Engineer
Or Certified Land Surveyor

(Seal)

Virginia Registered
Professional Engineer

STORMWATER MANAGEMENT / BMP FACILITIES RECORD DRAWING CHECKLIST

(Key for Checklist is as follows: XX Acceptable N/A Not Applicable Inc Incomplete)

I. Methods and Presentation: *(Required for all Stormwater Management / BMP facilities.)*

- XX 1. All constructed facilities meet approved design plans, unless otherwise shown. Record information or deviations from approved design plan shown in clearly annotated format and/or boxed beside design values.
- XX 2. Elevations to the nearest 0.1' unless higher accuracy is needed to show positive drainage.
- XX 3. All plan sheets labeled with "RECORD DRAWING" in large text in lower right hand corner (Approved County Plan Number and BMP ID Code can be included if known).
- XX 4. All plans sheet revision blocks modified to indicate date and record drawing status.
- XX 5. All plan sheets have certification statements and certifying professional's signature and seal.

II. Minimum Standards: *(Required for all Stormwater Management / BMP facilities, as applicable.)*

- XX 1. All requirements of Section I (Methods and Presentation) apply to this section.
- XX 2. Plan Views: Show general location, arrangement and dimensions. Location and alignment shall generally match approved design plans.
- XX 3. Profile or elevations along top or berm of the facility. At a minimum, elevations are required at each end, at intervals not to exceed 50 feet and where low spots may be present. Top of embankment or berm elevations must be no less than design elevation plus any settlement allowances.
- XX 4. Top widths, berm widths and embankment side slopes.
- XX 5. Show length, width and depth of facility or grading, contours or spot elevations as required to verify permanent pool and design storage volumes were met or were reasonably close to the approved design. Evaluation of as-built grading, contours, spot elevations, or cross-sections, may be necessary by the professional to ensure approved design configurations, depths and volumes were closely maintained. If grading or elevations are significantly different from the approved plan, the Environmental Division shall be contacted immediately to determine whether the variation is acceptable or whether further evidence will be required. Facilities which do not closely resemble approved plan grades, elevations or configurations may require regrading by the Contractor; check volumetric computations; and/or a check hydraulic routing to ensure approved design water surface elevations, discharges or freeboard were closely maintained.
- XX 6. Cross-section of the embankment through the principal spillway or outlet barrel. Must extend at least 100 ft. downstream of the pipe outlet or to recorded site property line, whichever is closer. Proper correlation is required between principal spillway (control structure) crest, emergency spillway crest, orifice and weirs and the top of the dam or facility. All elevations and dimensions must reasonably match the design plan or be sequentially relative to each other and the facility must reflect the required design storage volume(s) and/or design depth.
- XX 7. Profile or elevations along the entire centerline of the emergency spillway. Emergency spillway may be steeper, but no flatter or narrower than design.
- XX 8. Elevation of the principal spillway crest or outlet crest of the structure.

- | | | |
|------------|-----|---|
| <u>XX</u> | 9. | Primary control structure (riser) diameter or dimensions, height, type of material and base size. Indicate provisions for access that are present such as steps, ladders, etc. |
| <u>XX</u> | 10. | Dimensions, locations and elevations of outlet orifices, weirs, slots and drains. |
| <u>N/A</u> | 11. | Type and size of anti-vortex and trash rack device. Height, diameter, dimensions, bar spacings (if applicable) and elevations relative to the principal spillway crest. Indicate if lockable hatch is present or not. |
| <u>XX</u> | 12. | Type, location, size and number of anti-seep collars or documentation of other methods utilized for seepage control. May need to obtain this information during construction. |
| <u>XX</u> | 13. | Top of impervious core embankment, core trench limits and elevation of cut-off trench bottom. May need to obtain this information during construction. |
| <u>XX</u> | 14. | Elevation of the principal spillway barrel (outlet pipe) inlet and outlet invert. |
| <u>XX</u> | 15. | Outlet barrel diameter, length, slope, type and thickness class of material and type of flared end sections, headwall or endwall. |
| <u>XX</u> | 16. | Outfall protection dimension, type and depth of rock and if underlain filter fabric is present. |
| <u>N/A</u> | 17. | BMP interior and periphery landscaping zones conform with arrangements and requirements of the approved design plan. |
| <u>N/A</u> | 18. | Maintenance plan taken from approved design plan transposed onto record drawing set. |
| <u>N/A</u> | 19. | Fencing location and type, if applicable to facility. |
| <u>XX</u> | 20. | BMP vicinity properly cleaned of stockpiles and construction debris. |
| <u>XX</u> | 21. | No visual signs of erosion or channel degradation immediately downstream of facility. |
| <u>XX</u> | 22. | Any other information formally requested by the Environmental Division specific to the constructed SWM/BMP facility. |

STORMWATER MANAGEMENT / BMP FACILITIES RECORD DRAWING CHECKLIST

(Key for Checklist is as follows: XX Acceptable N/A Not Applicable Inc Incomplete)

VIII. Group F – Extended Dry Detention *(Includes F-1 Timber Walls; and F-2 Dry Extended Detention with Forebay)*

- | | | |
|------------|------|---|
| <u>XX</u> | F1. | All requirements of Section II, Minimum Standards, apply to Group F facilities. |
| <u>XX</u> | F2. | Basin bottom has positive slope and drainage from all basin inflow points to the riser (or outflow) location. |
| <u>N/A</u> | F3. | Timber wall BMP used in intermittent stream only. (ie. Prohibited in perennial streams.) |
| <u>Inc</u> | F4. | Forebay provided approximately 20 ft. upstream of the facility. Forebays generally 4 to 6 feet in depth. |
| <u>N/A</u> | F5. | A reverse slope pipe, vertical stand pipe or mini-barrel and riser was provided to prevent clogging |
| <u>XX</u> | F6. | Principal spillway and outlet barrel provided consisting of reinforced concrete pipe with O-Ring gaskets for watertight joint construction. |
| <u>N/A</u> | F7. | Mini-barrel and riser, if used, contains a removable trash rack to reduce clogging. |
| <u>XX</u> | F8. | Low flow orifice, if used, has a minimum diameter of three (3) inches or two (2) inches if internal orifice control was utilized and a small, cage type external trash rack. |
| <u>N/A</u> | F9. | Timbers properly reinforced or concrete footing provided if soil conditions were prohibitive. |
| <u>N/A</u> | F10. | Timber wall cross members extended to a minimum depth of two (2) feet below ground elevation. |
| <u>N/A</u> | F11. | Protection against erosion and scour from the low flow orifice and weir-flow trajectory provided. |
| <u>XX</u> | F12. | Stilling basin or standard outlet protection provided at principal spillway outlet. |
| <u>XX</u> | F13. | Adequate, direct access provided to the facility. Access corridor to facility is at least ten (10) feet wide, slope is less than twenty (20) percent and appropriate stabilization provided for equipment and vehicle use. Access extends to forebay, standpipe and timber wall, as applicable. |
| <u>N/A</u> | F14. | No visual signs of undercutting of timber walls or clogging of the low orifice were present. |
| <u>XX</u> | F15. | No visual signs of erosion or channel degradation immediately downstream of facility. |
| <u>XX</u> | F16. | No visible signs of accumulated silt/sediment were present in the facility following construction or alternately, accumulated silt/sediment was properly removed and no adverse affects to the function of the facility are anticipated. |

CURRENTLY FUNCTIONING AS A SEDIMENT BASIN.

STORMWATER MANAGEMENT / BMP FACILITIES RECORD DRAWING CHECKLIST

(Key for Checklist is as follows: XX Acceptable N/A Not Applicable Inc Incomplete)

X. Storm Drainage Systems (Associated with BMP's Only)

(Includes all incidental stormwater drainage conveyance systems associated with SWM/BMP facilities such as onsite or offsite storm drains, open channels, inlets, manholes, junctions, outlet protections, deflectors, etc. These facilities are external to the treatment function of, but are directly associated with drainage to and/or from a constructed SWM/BMP facility. The intent of this portion of the certification is to accurately identify the type and quantity of inflow or outflow points associated with the facility for future reference. The Professional may use his/her own discretion to determine inclusive facilities to meet the intent of this section. As a general rule, storm drainage systems would include incidental facilities to the nearest access structure upslope or downslope from the normal physical limits of the facility or 800 feet of storm drainage conveyance system length, whichever is less.)

- XX SD1. All requirements of Section II, Minimum Standards, apply to Storm Drainage Systems.
- XX SD2. Horizontal location of all pipe and structures relative to the SWM/BMP facility.
- XX SD3. Type, top elevation and invert elevation of all access type structures (inlets, manholes, etc.).
- XX SD4. Material type, size or diameter, class, invert elevations, lengths and slopes for all pipe segments.
- XX SD5. Class, length, width and depth of riprap and outlet protections or dimensions of special energy dissipation structures.

XII. Other Systems

(Includes any non-typical, specialty, manufactured or innovative stormwater management/BMP practices or systems generally accepted for use as or in conjunction with other acceptable stormwater management / BMP practices. Requires evidence of prior satisfactory industry use and prior Environmental Division approval, waiver or exception.)

- N/A O1. All requirements of Section II, Minimum Standards, apply to this section.
- N/A O2. Certification criteria to be determined on a case-by-case basis by the Environmental Division specific to the proposed SWM/BMP facility.

AES CONSULTING ENGINEERS
Engineering, Surveying, and Planning
 5248 Olde Towne Road, Suite 1
 WILLIAMSBURG, VIRGINIA 23188

Phone: (757) 253-0040
Fax: (757) 220-8994

LETTER OF TRANSMITTAL

ATTN: **Mr. Darryl Cook**

CO.: **JCC Environmental Division**

Address:

CC:

DATE 11/12/04	JOB NO. 7555-12
FROM: Charles Records	
RE Williamsburg Plantation Section 5 SWM As-builts	

WE ARE SENDING YOU THE FOLLOWING ITEMS:

☒ Attached
☐ Under separate cover via

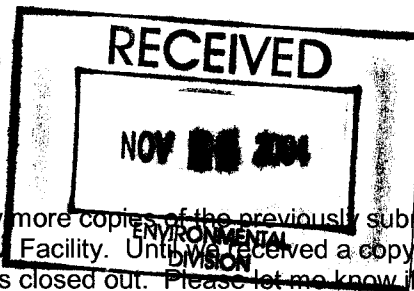
☐ Original(s) ☐ Print(s) ☐ Plan(s) ☐ Specification(s) ☐ Change Order
☐ Copy of letter(s) ☐ Other:

COPIES	DATE	No. of Pages	DESCRIPTION
2			SWM Record Drawings
2			Construction Certification Documents

THESE ARE TRANSMITTED as checked below:

☒ For your approval ☐ For your signature ☐ For review and comment
☒ For your use ☐ As you requested ☐ As requested by:
☐ Other:

REMARKS:
 Darryl,



Here are a few more copies of the previously submitted information for the Williamsburg Plantation Section 5 SWM Facility. Until we received a copy of the Letter of Credit extension request letter, I thought this project was closed out. Please let me know if you have any questions or need any additional information. Thanks.

Charles Records

If enclosures are not as noted, kindly notify us at once.



FOUNDATION ENGINEERING SCIENCE, INC.

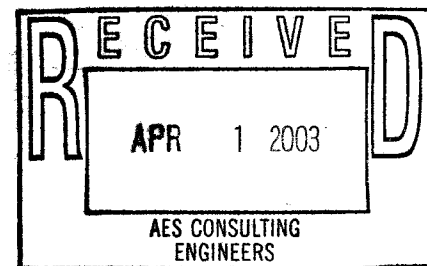
- Geotechnical Engineering [Drilling; Foundation, Retaining Wall & Pavement Design]
- Environmental Management [Phase I & II, Asbestos and Lead Paint Sampling]
- Construction Materials Testing & Inspection [Quality Control & Quality Assurance]
- Foundation & Pavement Problems Evaluations & Remediations
- Value Engineering During Design & Construction

RECEIVED MAY 23 2002

Mr. J.P. Ottino III, V.P.
Williamsburg Plantation, Inc.
 Berkeley South Building
 Executive Suite 121
 3015 N. Ocean Boulevard
 Ft. Lauderdale, Florida 33308

May 20, 2002

Re: Earthen Dam Certification Report
Williamsburg Plantation, Section Five - Earthen Dam
 James City County, Virginia
 FES Report No. 1-9C120.345



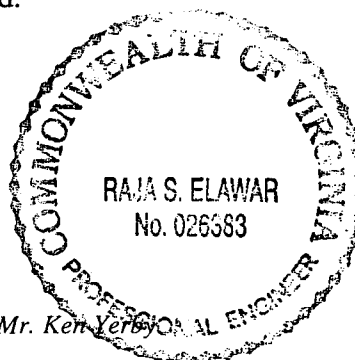
Dear Mr. Ottino:

Foundation Engineering Science, Inc. (FES) hereby certifies to the best of our knowledge and belief that the Earthen Dam for the Storm Water Management/BMP facility for Williamsburg Plantation, Section Five was monitored and constructed in general accordance with the provisions of the approved design plans, specifications and storm water management plan.

FES appreciates the opportunity to be of service to **Williamsburg Plantation, Inc.** on this important project and looks forward to its successful completion. Should you have any questions regarding this report, please do not hesitate to contact the undersigned.

Respectfully submitted,
FOUNDATION ENGINEERING SCIENCE, INC.

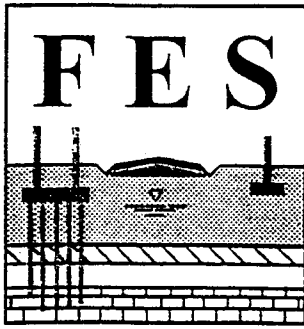
[Signature]
 Idres Hawarry 5/20/02
 Project Engineer



[Signature] 5/20/02
 Raja S. El-Awar, P.E.
 Principal Engineer
 VA Reg. No. 26383

XCopies: (1) Bush Companies-Plantation Group, LLC - Mr. Ken Yerby
 (1) James City County - Mr. Gerald E. Lewis
 (1) VDOT - Mr. Mark D. Yeatts
 (1) George Nice & Sons, Inc. - Mr. Ray Nice, P.E.
 (1) AES Consulting Engineers - Mr. Richard Costello, P.E.

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FOUNDATION ENGINEERING SCIENCE, INC.

- Geotechnical Engineering [Drilling; Foundation, Retaining Wall & Pavement Design]
- Environmental Management [Phase I & II, Asbestos and Lead Paint Sampling]
- Construction Materials Testing & Inspection [Quality Control & Quality Assurance]
- Foundation & Pavement Problems Evaluations & Remediations
- Value Engineering During Design & Construction

Mr. Ken Yerby
Williamsburg Plantation Inc.
4029 Ironbound Road, Suite 200
Williamsburg, Virginia 23188

June 5, 2001

Re: Interim Earthen Dam Report
Williamsburg Plantation, Coach House Lane-Earthen Dam
James City County, Virginia
FES Report No. 1-9C120.145


Dear Mr. Yerby:

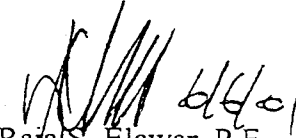
Foundation Engineering Science, Inc. (FES) hereby certifies to the best of our knowledge and belief that the Storm Water Management/BMP facility for Williamsburg Plantation, Coach House Lane was monitored and constructed in general accordance with the provisions of the approved design plans, specifications and storm water management plan.

FES appreciates the opportunity to be of service to **Williamsburg Plantation, Inc.** on this important project and looks forward to its successful completion. Should you have any questions regarding this report, please do not hesitate to contact the undersigned.

Respectfully submitted,

FOUNDATION ENGINEERING SCIENCE, INC.


Idres Hawary
Project Engineer


Raja S. Elawar, P.E.
Principal Engineer
VA Reg. No. 26383

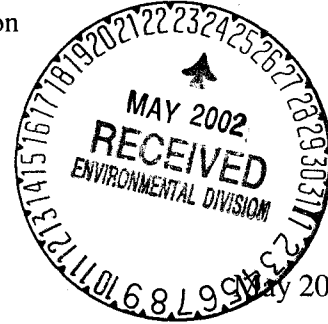
XCopies: (1) Client

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FOUNDATION ENGINEERING SCIENCE, INC.

- Geotechnical Engineering [Drilling; Foundation, Retaining Wall & Pavement Design]
- Environmental Management [Phase I & II, Asbestos and Lead Paint Sampling]
- Construction Materials Testing & Inspection [Quality Control & Quality Assurance]
- Foundation & Pavement Problems Evaluations & Remediations
- Value Engineering During Design & Construction



Mr. J.P. Ottino III, V.P.
Williamsburg Plantation, Inc.
Berkeley South Building
Executive Suite 121
3015 N. Ocean Boulevard
Ft. Lauderdale, Florida 33308

PC 175; SP-103-00

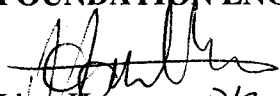
Re: Earthen Dam Certification Report
Williamsburg Plantation, Section Five - Earthen Dam
James City County, Virginia
FES Report No. 1-9C120.345

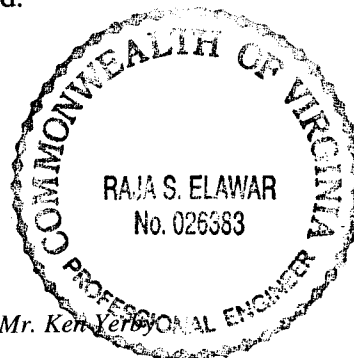
Dear Mr. Ottino:

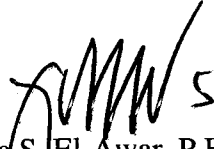
Foundation Engineering Science, Inc. (FES) hereby certifies to the best of our knowledge and belief that the Earthen Dam for the Storm Water Management/BMP facility for Williamsburg Plantation, Section Five was monitored and constructed in general accordance with the provisions of the approved design plans, specifications and storm water management plan.

FES appreciates the opportunity to be of service to **Williamsburg Plantation, Inc.** on this important project and looks forward to its successful completion. Should you have any questions regarding this report, please do not hesitate to contact the undersigned.

Respectfully submitted,
FOUNDATION ENGINEERING SCIENCE, INC.


Idres Hawarry 5/20/02
Project Engineer



 5/20/02
Raja S. El-Awar, P.E.
Principal Engineer
VA Reg. No. 26383

XCopies: (1) Bush Companies-Plantation Group, LLC - Mr. Ken Yerbey
(1) James City County - Mr. Gerald E. Lewis
(1) VDOT - Mr. Mark D. Yeatts
(1) George Nice & Sons, Inc. - Mr. Ray Nice, P.E.
(1) AES Consulting Engineers - Mr. Richard Costello, P.E.

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9 PT. BMP
47AC
19.46 onsite
27.34 offsite

James City County, Virginia
Environmental Division

Stormwater Management/BMP
Record Drawing and Construction Certification Review
Tracking Form

County Plan No.:

Project Name:

Stormwater Management Facility:

Phase:

SP-103-00

WMB6 PLANTATION SEC 5 (VDOT FACILITY 6)

DRY POND

☐ I ☐ II ☒ III

☒ Information Received.

Date/By: MAR 28 '03 AES

☒ Administrative Check.

☒ Record Drawing

Date/By: 3/27/03 AES; AB (PT) 3/27/03 AES

☒ Construction Certification

Date/By: 5/20/02 FES

☒ RD/CC Standard Forms

(Required for all BMPs after Feb 1st 2001 Only)

☐ Insp/Maint Agreement

#/Date:

☐ BMP Maintenance Plan

Location:

☐ Other:

☐ Standard E&SC Note on Approved Plan Requiring RD/CC or County comment in plan review file.

☒ Yes ☐ No

Location:

☒ Assign County BMP ID Code:

Code: PC175

☒ Preliminary Input into Division's "As-Built Tracking Log"

☒ Add Location to GIS Database Map. Obtain site information (GPIN, Owner, Site Area, Address, etc.)

☒ Preliminary Log into Access BMP Database (BMP ID #, Plan No., GPIN, Project Name, etc.)

☒ Active Project File Review (correspondence, H&H, etc.).

☒ Initial As-Built File setup (Label, copy hydraulics, BMP plan and detail information, etc.).

☒ Inspector Check of RD/CC (forward to inspector using transmittal for cursory review).

☒ Pre-Inspection Drawing Review - Approved Plan (Quick look prior to Field Inspection).

☒ Final Inspection (FI) Performed

Date: 11/16/04 WAC

☒ Record Drawing (RD) Review (***)

Date: WAC

☒ Construction Certification (CC) Review

Date: SIT

☐ Actions:

☒ No comments.

☐ Comments. Letter Forwarded.

Date:

☐ Record Drawing (RD)

☐ Construction Certification (CC)

☐ Construction-Related (CR)

☐ Site Issues (SI)

☐ Other :

☐ Second Submission:

☐ Reinspection (if necessary):

☐ Acceptable for stormwater management facility purposes (RD/CC/CR/Other). Proceed with bond release.

☐ If ok for full release, notify Inspector and Inspector Supervisor using "Surety Request Form".

☒ Check/Clean active file of any remaining material and finish "As-Built" file.

☒ Add to County BMP Inventory/Inspection schedule (Phase I, II or III).

☒ Copy Final Inspection Report into County BMP Inspection Program file.

☒ Obtain Digital Photographs of BMP and log into computer.

☐ Add to JCC Hydrology & Hydraulic database (optional).

☐ Complete "As-built Tracking Log".

BMP Certification Information Acceptable

Plan Reviewer:

Date:

*** See separate checklist.

PRIDE ✓

11/14/04
RECEIVED
10-17-05



David A. Steele, PE
Interim Resident Engineer

January 12, 2005

GEORGE NICE & SONS, INC.
143 SKIMINO ROAD
WILLIAMSBURG, VA 23188

Attention: S. RAY NICE, P.E.

Land Use Permit Completion Notice	
Permit Number:	535-22779
Route:	199, Route 199
Location:	James City
Your Reference Number:	
Completion Date:	1/12/2005 8:33:02 AM
Surety Type:	Single Performance Bond
Surety Amount:	100000
Obligation Amount:	100000
Refund Amount:	100000

Dear Permittee:

In early January, we received the As-Built drawings for the Williamsburg Plantation SWMB on Rte. 199 in James City County. This was the final punch list item required to complete this permit. With all the other items being taken care of, the permit referenced above has been satisfactorily completed.

If you have any questions, please contact the following Permit section:

Williamsburg Residency
4451 Ironbound Rd.
Williamsburg, VA 23188
(757)253-4832

Sincerely,

Mark D. Yeatts

Mark D. Yeatts
Permit and Subdivision Specialist Senior

SCOTT, 1/14/64
WITH THIS INFORMATION
FROM VDOT, I BELIEVE
THE BOMB ON THE REFERENCED
BOMB CAN BE RELEASED.

Cc: Ken Yerby, Plantation Group, LLC
James City County Environmental Division

Bill
ok to do surety
request form.



Stormwater Management / BMP Inspection Report

Detention and Retention Pond Facilities

County BMP ID Code (if known): PC 175

Name of Facility: DRY POND BMP No.: 1 of 1 Date: 11/16/04

Location: WILLIAMSBURG PLANTATION SECTION 5 BAY 199 & WINDMILL FIELDS WAY

Name of Owner: VIRDOT

Name of Inspector: BILL CAIN

Type of Facility: DRY BASIN

Weather Conditions: SUNNY Type: ☒ Final Inspection ☐ County BMP Inspection Program ☐ Owner Inspection

If an inspection item is not applicable, mark NA, otherwise mark the appropriate column.

- O.K. - The item checked is in adequate condition and the maintenance program is currently satisfactory. No action required.
Routine - The item checked requires attention, but does not present an immediate threat to the function/integrity of the BMP.
Urgent - The item checked requires immediate attention to keep the BMP operational and to prevent damage to the facility.

Provide an explanation and details in the comment column, if routine or urgent are marked.

Facility Item	O.K.	Routine	Urgent	Comments
Embankments and Side Slopes:				
Grass Height	✓			24"-36" No RIBS
Vegetation Condition	✓			
Tree Growth	✓			
Erosion	✓			
Trash & Debris	✓			
Seepage	✓			
Fencing or Benches				
Interior Landscaping/Planted Areas: <input checked="" type="checkbox"/> None <input type="checkbox"/> Constructed Wetland/Shallow Marsh <input type="checkbox"/> Naturally Established Vegetation				
Vegetated Conditions				
Trash & Debris				
Floating Material				
Erosion				
Sediment				
Dead Plant				
Aesthetics				
Other				
Notes: CAT TAILS INVADED BASIN ENTIRELY				

Facility Item	OK	Routine	Urgent	Comments
Water Pools: <input type="checkbox"/> Permanent Pool (Retention Basin) <input type="checkbox"/> Shallow Marsh (Detention Basin) <input checked="" type="checkbox"/> None, Dry (Detention Basin)				
Shoreline Erosion	/			
Algae	/			
Trash & Debris	/			
Sediment	/			
Aesthetics	/			
Other				
Inflows (Describe Types/Locations):				
Condition of Structure	/			
Erosion	/			
Trash and Debris	/			
Sediment	/			
Outlet Protection	/			
Other				
Principal Flow Control Structure - Riser, Intake, etc. (Describe Type): <i>DE-7 (VERT-LID)</i>				
Condition of Structure	/			
Corrosion	/			
Trash and Debris	/			
Sediment	/			
Vegetation	/			
Other				
Principal Outlet Structure - Barrel, Conduit, etc. :				
Condition of Structure	.			
Settlement	.			
Trash & Debris	/			
Erosion/Sediment	/			
Outlet Protection	/			
Other				
Emergency Spillway (Overflow):				
Vegetation	/			
Lining	/			
Erosion	/			
Trash & Debris	/			
Other	/			
Notes:				

Nuisance Type Conditions:

Mosquito Breeding

✓

Animal Burrows

✓

Graffiti

✓

Other

Surrounding Perimeter Conditions:

Land Uses

✓

Vegetation

✓

Trash & Debris

✓

Aesthetics

✓

Access /Maintenance
Roads or Paths

✓

Other

Remarks:

DOT 7E-7 Southwest side of 199 HAS EROSION ALL AROUND SIDES OF MH STRUCTURE. 36" CULVERT MAY BE IN PROCESS OF UNDERMINING ENTRANCE/ACCESS FROM 199. PORTION OF ACCESS ROAD IN PROXIMITY TO ES ~~WAS~~ ERODING 1/2 100' X 2' X 2' @ TOWARD ES. NO DANGER OF CONTRIBUTING TO BMP FAILURE.

Overall Environmental Division Internal Rating: 3

Signature: [Signature]

Date: 11/16/04 wlc

Title: CIVIL ENGINEER

SURETY REQUEST FORM

Jordan

Project Name: Williamsburg Plantation - Section 5 Units 91-12
Phase 1 & 2

Requested By: PM

Phone Number: _____

Date Requested: 10-12-04 DUE 10-19-04

Date Completed & Requester Notified: _____

Scott,
Action Request: _____

☐ Do you know of any outstanding issues with the BMP on this project?
Please let me know
Thanks
Jordan

Calculate ☐ Reduce ☐ Release ☐

Surety Amount Needed \$ _____

Comments _____

☒ Erosion Control Surety Calculate ☐ Reduce ☐ Release ☐

Checklist SP-103-00; PC175

☐ BMP Certification / Record Drawings Asbuilt & Const Cert received but not reviewed yet. Final inspection not performed yet. Hold 50% of BMP cost + reduce bond

Surety Amount Needed \$ _____

Comments _____

INDICATE YOUR APPROVAL BY INITIALING THE APPROPRIATE BLANK:

INSP. _____ DEC _____ ST 11/10/04 PTM _____

RECORD OF PHONE CONVERSATION

Call To: Ken Yerby – 220-2874

Date: 5/14/02

Call By: Bob Lane

Re: Williamsburg Plantation-Dam Certification and As-builts
Phase 5

I asked Ken about the status of the certification and the as-built drawings. He called back after talking with Rich Costello, FES. According to Rich, they will complete the as-builts and assemble the certification package within 30 days. (They prefer to wait until the grass is established to do the as-built work.) They intend to send us a complete package at that time.

WMBG PLANTATION
SEC 5: UNITS 97-133
SP-103-00; PC 175
Sum/BMP FACILITY G
UNIT PROJECT #
0199-047-F30; PE-103;
RW-204; C-501

LOG
CERT INFO
WMBG PLANT
SEC 5
UNIT BMP

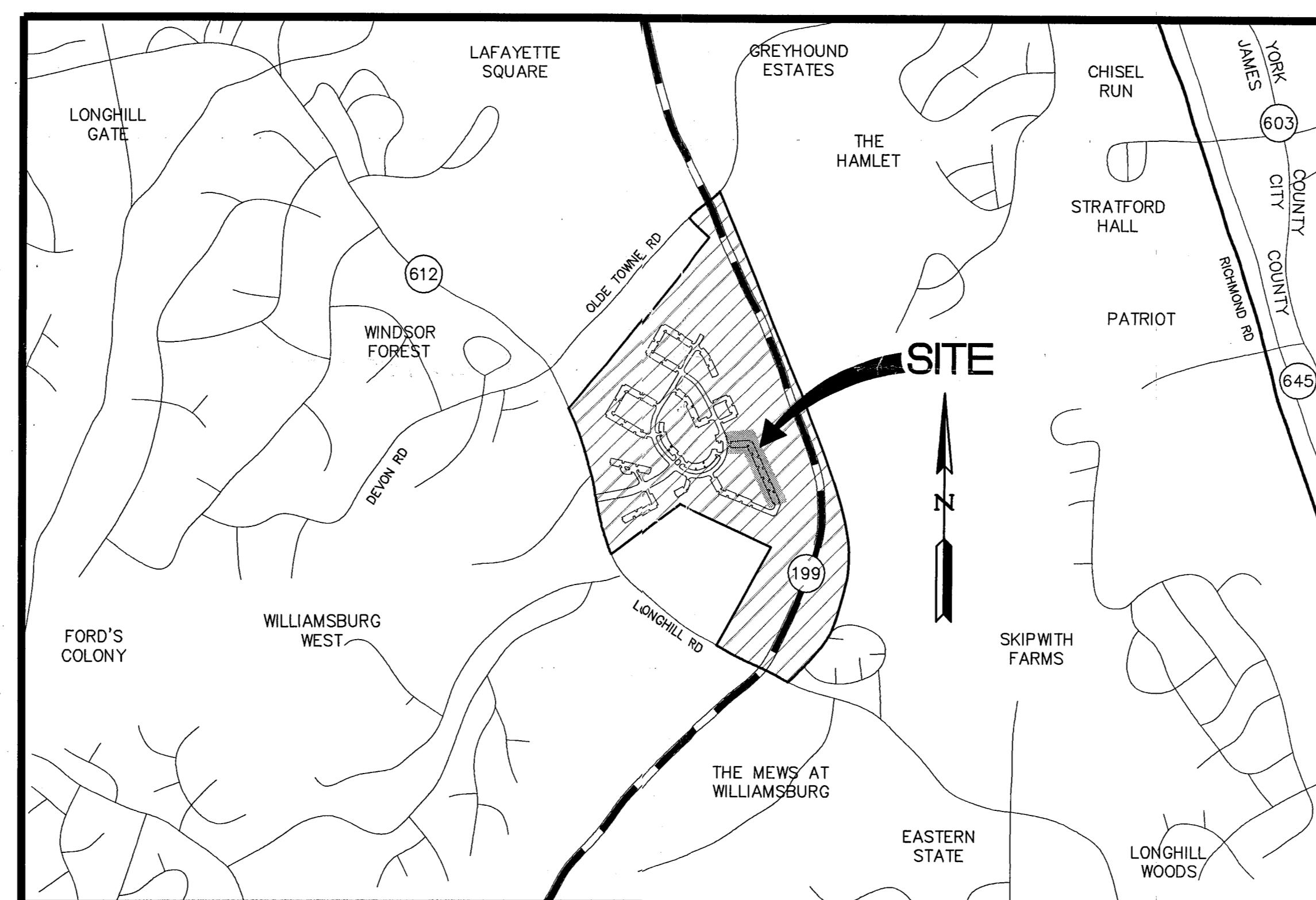
WILLIAMSBURG PLANTATION

SECTION 5: UNITS 97-133

GENERAL NOTES

- PROPERTY ZONING: LIMITED RESIDENTIAL DISTRICT R-2.
- PROPERTY TAX PARCEL NO.: PART OF (32-4) (1-26C)
- PROPERTY ADDRESS: 4870 LONGHILL ROAD
- THIS SITE PLAN IS FOR A SECTION OF TIMESHARE UNITS WHICH IS PART OF AN APPROVED OVERALL CLUSTER DEVELOPMENT PLAN (JCC CASE NO. MP-02-00).
- THE UNITS ARE 2 STORIES, USE GROUP B, AND CONSTRUCTION TYPE 3B. MAXIMUM BUILDING HEIGHT IS 35 FEET.
- OVERALL SITE DENSITY IS 3.99 UNITS/ ACRE AS APPROVED WITH AMENDED MASTER PLAN MP-02-00. TOTAL APPROVED UNITS TO DATE = 96 UNITS.
- ALL UTILITIES SHALL BE PLACED UNDERGROUND AND SHALL HAVE A MINIMUM OF 36" OF COVER.
- THE CONTRACTOR SHALL SATISFY HIMSELF AS TO ALL SITE CONDITIONS PRIOR TO CONSTRUCTION. CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND SHALL NOTIFY MISS UTILITY (1-800-552-7001) PRIOR TO ANY EXCAVATION OR DEMOLITION.
- VERIFY ALL DIMENSIONS AND NOTIFY JAMES CITY SERVICE AUTHORITY PRIOR TO ANY EXCAVATION OR DEMOLITION WITHIN UTILITY CORRIDORS.
- THE CONTRACTOR IS RESPONSIBLE FOR OBTAINING ALL NECESSARY PERMITS PRIOR TO COMMENCEMENT OF WORK, TO INCLUDE, BUT NOT LIMITED TO, JAMES CITY COUNTY LAND DISTURBANCE, BUILDING, AND UTILITY.
- A LAND DISTURBING PERMIT AND SILTATION AGREEMENT, WITH SURETY, ARE REQUIRED FOR THIS PROJECT.
- CONTRACTOR SHALL BE RESPONSIBLE FOR THE COORDINATION OF CONSTRUCTION EFFORTS WITH VIRGINIA NATURAL GAS, VIRGINIA POWER, APPROPRIATE TELEPHONE COMPANY, APPROPRIATE CABLE COMPANY, JAMES CITY SERVICE AUTHORITY, AND OTHERS THAT MAY BE REQUIRED.
- PROJECT TO BE SERVED BY PUBLIC WATER AND SEWER OWNED BY THE JAMES CITY SERVICE AUTHORITY. ALL PROPOSED WATER AND SANITARY IMPROVEMENTS TO BE CONSTRUCTED IN ACCORDANCE WITH JCSA STANDARDS AND SPECIFICATIONS.
- ALL PARKING SPACES SHALL BE DELINEATED WITH PAINT STRIPING. THE MINIMUM NUMBER OF PARKING SPACES SHALL BE 2.5 PER DWELLING UNIT, IN ACCORDANCE WITH SEC. 24-59 (A) (1) OF THE JCC ZONING ORDINANCE. HANDICAP PARKING SPACES SHALL BE DESIGNATED BY ABOVE GROUND SIGNS PER USBC REQUIREMENTS.
- REFUSE TO BE REMOVED BY PRIVATE CONTRACTOR.
- THE SITE DOES NOT LIE WITHIN ANY RESOURCE PROTECTION AREAS.
- THIS PROPERTY LIES IN ZONE "X" (AREAS DETERMINED TO BE OUTSIDE THE 500 YEAR FLOOD PLAIN) AS SHOWN ON COMMUNITY PANEL #510201 0035 B, DATED 2/6/ 1991 OF THE FLOOD INSURANCE RATE MAPS FOR JAMES CITY COUNTY, VIRGINIA.
- CONTOUR INTERVAL IS ONE FOOT.
- ANY NEW SIGNS SHALL BE IN ACCORDANCE WITH ARTICLE II, DIVISION 3 OF THE JCC ZONING ORDINANCE.
- ANY OLD WELLS THAT MAY BE ON-SITE THAT WILL NOT BE USED MUST BE PROPERLY ABANDONED ACCORDING TO STATE PRIVATE WELL REGULATIONS AND JAMES CITY COUNTY CODE.
- OWNER/ DEVELOPER: THE BERKELEY GROUP
MR. J.P. OTTINO, III
BERKELEY SOUTH BLDG, EXEC. SUITE 115
3015 N. OCEAN BLVD
FT. LAUDERDALE, FL 33308

WILLIAMSBURG PLANTATION, INC.

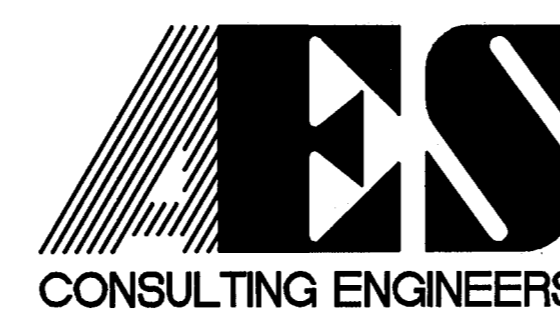


VICINITY MAP (APPROX. SCALE 1"=1000')

DATE: AUGUST 23, 2000
REVISED: NOVEMBER 16, 2000
PROJECT NO.: 7555-12

INDEX OF SHEETS

SHEET NUMBER	DESCRIPTION
1	COVER SHEET
2	SITE AND UTILITY PLAN/GRADING, DRAINAGE AND E&S PLAN (PHASE I)
2A	UTILITY PROFILES, NOTES AND DETAILS (PHASE I)
3	SITE PLAN (PHASE II)
3A	INTERIM GRADING, EROSION AND SEDIMENT CONTROL PLAN (PHASE II)
3B	GRADING, EROSION AND SEDIMENT CONTROL PLAN (PHASE II)
4	DRAINAGE AND UTILITY PLAN
5	UTILITY PROFILES
6	LANDSCAPE PLAN AND DETAILS
7	LIGHTING PLAN AND DETAILS
8	ENVIRONMENTAL INVENTORY
9	NOTES AND DETAILS
10	NOTES AND DETAILS
11	SMP (VDOT FACILITY "G") NOTES AND DETAILS



5248 Olde Towne Road, Suite 1
Williamsburg, Virginia 23188
(757) 253-0040
Fax (757) 220-8994

RECORD DRAWING BASED ON INFORMATION AS
SURVEYED 5-02 & 3-04 BY A.E.S. CONSULTING
ENGINEERS

LEGEND

EXISTING	PROPOSED	EXISTING	PROPOSED
WATER	W	EXISTING TREELINE	
SANITARY SEWER	S	EXISTING TREE	
STORM SEWER	SS	LIMITS OF CLEARING	
FORCE MAIN	FM	SILT FENCE	
OVERHEAD TELEPHONE LINE	O/H TELE	WIRE REINFORCED SILT FENCE	
UNDERGROUND PHONE LINE	PHONE	INLET PROTECTION	
OVERHEAD ELECTRIC LINE	O/E	CHECK DAM	
GAS LINE	G	STRAW BALE BARRIER	
FIBER OPTIC	FO	DIVERSION DIKE	
OVERHEAD CABLE		RIP RAP	
MANHOLE		REVERSE GRADE GUTTER PAN	
CURB DROP INLET		BORING	
YARD DROP INLET		BENCH MARK	
FLARED END SECTION		GROUND ELEVATION	
VALVE		TOP OF CURB ELEV.	
FIRE HYDRANT ASSEMBLY		FINISH GRADE ELEV.	
BLOCK-OFF VALVE		TOP OF WALL ELEV.	
AIR RELEASE ASSEMBLY		GRADING LINE TIE-IN	
CLEAN OUT		EXISTING CONTOUR ELEV.	
WATER METER		CONTOUR ELEV.	
POWER POLE		GRADING BY OTHERS	
POWER POLE W/GUY WIRE		RESERVED PARKING	
LIGHT POLE		YARD HYDRANT	
STREETLIGHT		MAILBOX	
CENTERLINE/BASELINE		SIGN	
RIGHT OF WAY		WETLANDS	
PROPERTY LINE		RPA BUFFER	
DITCH/SWALE		25% SLOPES OR GREATER	
CONCRETE LINED DITCH		AREA OF FILL	
EC-3 LINED DITCH		HIGH POINT	
BITUMINOUS CONCRETE			
CONCRETE			
AGGREGATE/GRAVEL			

APPROVED
James City County
Environmental Division
By: [Signature]
Date: 3/10/04

I HEREBY CERTIFY TO THE BEST OF MY JUDGEMENT, KNOWLEDGE, AND BELIEF THAT THIS RECORD DRAWING REPRESENTS THE CONDITIONS OF THE SITE ON THE DATE IT WAS SURVEYED. THE SITE APPEARS TO CONFORM WITH THE PROVISIONS OF THE APPROVED DESIGN PLAN.

[Signature]
ENGINEER

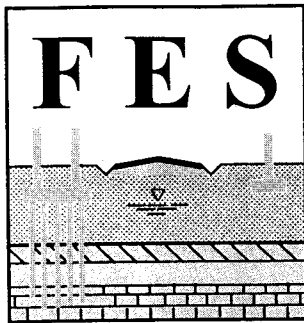
3/10/04
DATE



No.	DATE	REVISION / COMMENT / NOTE	BY
7	3/10/04	RECORD DRAWING STORM WATER MANAGEMENT/ BMP FACILITY	CBR
6	3/27/03	RECORD DRAWING STORM WATER MANAGEMENT/ BMP FACILITY	CBR
5	5/4/01	REVISED PER JCSA COMMENTS DATED 5/4/01	CBR
4	4/17/01	REVISED PER JCC ENVIR. COMMENTS AND TO INDICATE PHASING	CBR
3	3/23/01	REVISED PER VDOT COMMENTS (DRY POND) FACILITY "G"	CBR
2	11/16/00	REVISED PER JCSA COMMENTS	CBR
1	10/18/00	REVISED SITE LAYOUT & REVISIONS PER JCC COMMENTS	CBR

DAVE 253-5150
MEMOR

TEST/INSPECTION
Reports for
Dam



FOUNDATION ENGINEERING SCIENCE, INC.

- Geotechnical Engineering [Drilling; Foundation, Retaining Wall & Pavement Design]
- Environmental Management [Phase I & II, Asbestos and Lead Paint Sampling]
- Construction Materials Testing & Inspection [Quality Control & Quality Assurance]
- Foundation & Pavement Problems Evaluations & Remediations
- Value Engineering During Design & Construction

May 21, 2002

Mr. J.P. Ottino, III, V.P.
Williamsburg Plantation, Inc.
Berkley South Building
Executive Suite 121
3015 N. Ocean Boulevard
Fort Lauderdale, Florida 33308



Re: Field Compaction Density Report
Williamsburg Plantation, Section Five - Earthen Dam
James City County, Virginia
FES Report No. 1-9C120.348

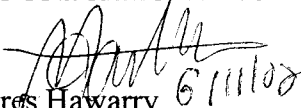
Dear Mr. Ottino:


Pursuant to the Contractor's request, a Foundation Engineering Science, Inc. (FES) representative visited the project site on May 15, 2002. The specific purpose of this visit was to perform compaction density testing on the design subgrade material for the access roadway within the earthen Dam. These tests were performed in general accordance with the American Society for Testing and Materials (ASTM) Test Designation D-2922, titled "Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)".

FES appreciates the opportunity to be of service to **Williamsburg Plantation, Inc.** on this important project and looks forward to its successful completion. Should you have any questions regarding this report, please do not hesitate to contact the undersigned.

Respectfully submitted,

FOUNDATION ENGINEERING SCIENCE, INC.


Idres Hawarry
Project Engineer


David L. Doran, E.I.T.
Project Engineer

Attachments: Field Compaction Density Report
Field Compaction Density Location Sketch

XCopies: (1) Bush Companies-Plantation Group, LLC - Mr. Ken Yerby
(1) James City County - Mr. Gerald E. Lewis
(1) VDOT - Mr. Mark D. Yeatts
(1) George Nice & Sons, Inc. - Mr. Ray Nice, P.E.
(1) AES Consulting Engineers - Mr. Richard Costello, P.E.

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FOUNDATION ENGINEERING SCIENCE, INC.

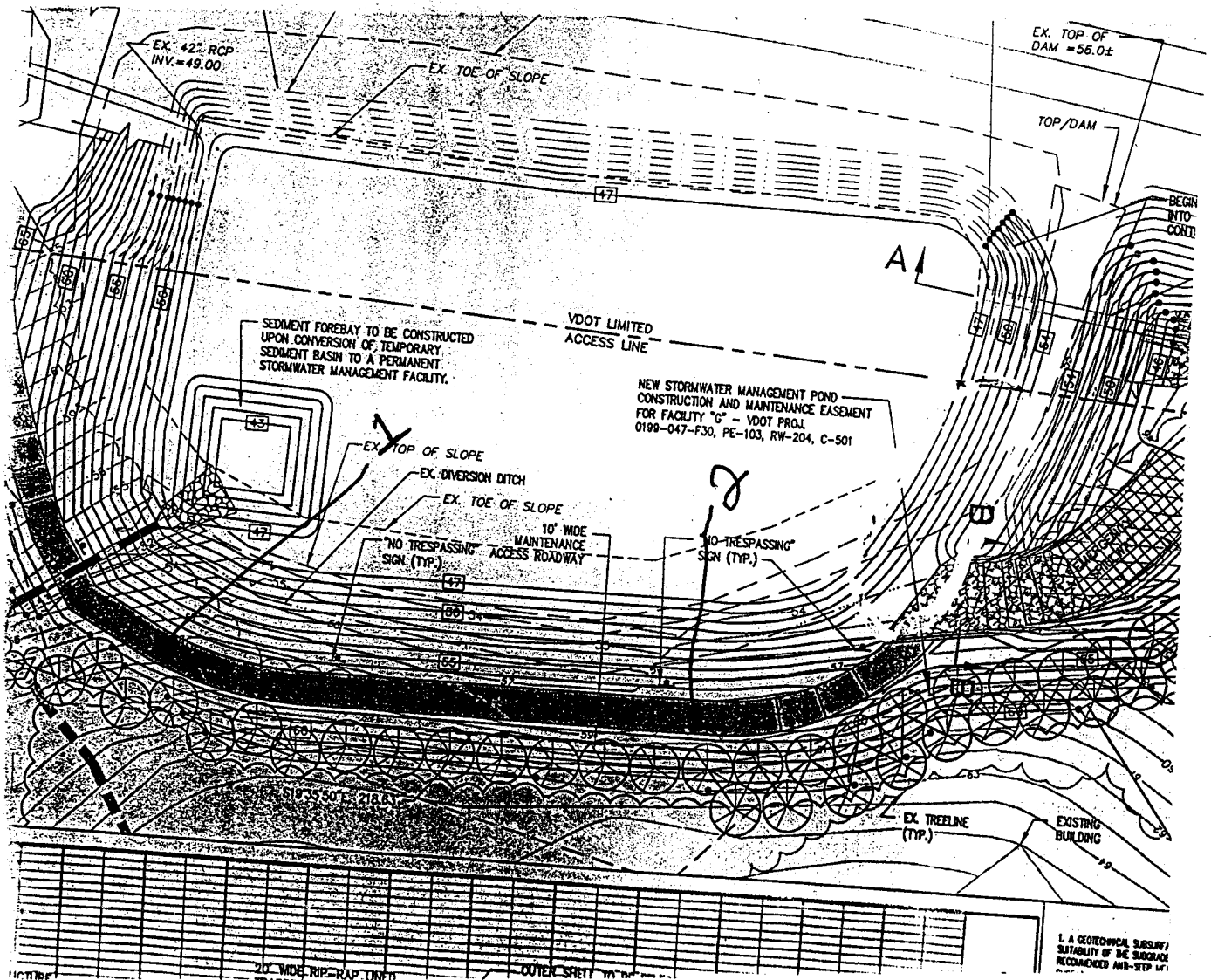
11843 B Canon Boulevard

Newport News, Virginia 23606

Telephone: (757) 873-4113 Fax: (757) 873-4114

FIELD COMPACTION DENSITY REPORT¹**Page 1 of 1**

Project Name		Williamsburg Plantation, Section Five - Earthen Dam				Date		May 15, 2002			
Project No.		1-9C120.348				General Contractor		The Bush Companies			
Client		Williamsburg Plantation, Inc. Berkley South Building Executive Suite 121 3015 N. Ocean Boulevard Fort Lauderdale, Florida 33308				Earth Contractor		George Nice & Sons, Inc.			
Project Location		James City County, Virginia				Weather		Clear			
Gauge #	26729	Model #	3430	Density Std. Ct.	2746	Moisture Std. Ct.	669	FES REP.:	TS		
Proctor	Dry Density ² (pcf)	Opt. Moist. (%)	Passing #200 ³ (%)	Material Description & Classification ⁴				Source		Compaction Requirement	
48	117.5	12.0	42.9	Reddish brown silty SAND (SM)				On-site		Moderate effort	
44	112.3	12.1	39.5	Brown silty SAND (SM)				On-site		Moderate effort	
TEST NO.	DEPTH (inches)	ELEVATION (feet)		PROC. NO.	D.D. (PCF)	MOIST (%)	W.D. (PCF)	% COMP	PASS	FAIL	REMARKS
1	12	Design Subgrade		44	109.1	15.3	125.7	97.2	X		
2	6	Design Subgrade		44	112.7	15.3	129.9	100.4	X		
3	12	Design Subgrade		48	117.5	13.9	133.8	100.0	X		
4	6	Design Subgrade		48	119.8	14.0	136.5	102.0	X		
TEST NO.		TEST LOCATION									
1		Site No. 1, Service Road, See attached figure									
2		Site No. 1, Service Road, See attached figure									
3		Site No. 2, Service Road, See attached figure									
4		Site No. 2, Service Road, See attached figure									
SPEC. REQUIREMENTS		Utility Trench		Sidewalk		Structure		Roadway/Parking		General (Dam)	
COMPACTION (%)								Top 12" ≥ 95.0 Top 6" 100.0%			
MOISTURE (%)								O.M. ± 20%			
Comments											
Compaction density testing was performed in general accordance with ¹ ASTM D2922, ² ASTM D698 (Procedure A), ³ ASTM D1140, ⁴ ASTM D2488 (Visual-Manual Procedure)											



FOUNDATION ENGINEERING SCIENCE, INC.
 GEOTECHNICAL, ENVIRONMENTAL & CONSTRUCTION INSPECTION

11843-B CANON BOULEVARD
 NEWPORT NEWS, VIRGINIA 23606
 PHONE: 757-873-4113 FAX: 757-873-4114
 EMAIL: RELAWAR@FESVA.COM

CONSTRUCTION INSPECTION SERVICES

**WILLIAMSBURG PLANTATION, SECTION
 FIVE - EARTHEN DAM**

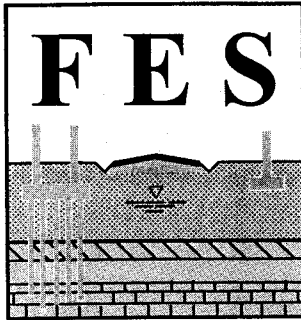
JAMES CITY COUNTY, VIRGINIA

DATE:
MAY 15, 2002

SCALE:
 N/A

FES REPORT NO.
 1-9C120.348

FIGURE - 1
FIELD DENSITY COMPACTION
LOCATION SKETCH



FOUNDATION ENGINEERING SCIENCE, INC.

- Geotechnical Engineering [Drilling; Foundation, Retaining Wall & Pavement Design]
- Environmental Management [Phase I & II, Asbestos and Lead Paint Sampling]
- Construction Materials Testing & Inspection [Quality Control & Quality Assurance]
- Foundation & Pavement Problems Evaluations & Remediations
- Value Engineering During Design & Construction

Mr. J.P. Ottino III, V.P.
Williamsburg Plantation, Inc.
 Berkeley South Building
 Executive Suite 121
 3015 N. Ocean Boulevard
 Ft. Lauderdale, Florida 33308

May 20, 2002



Re: Design Subgrade Evaluation Report
Earthen Dam Maintenance Access Road
Williamsburg Plantation, Section Five
 James City County, Virginia
 FES Report No. 1-9C120.344

Dear Mr. Ottino:

Pursuant to the grading contractor's request an experienced Geotechnical Engineer with Foundation Engineering Science, Inc. (FES) visited the project site on May 15, 2002. The specific purpose of this visit was to observe the design subgrade for the Earthen Dam Maintenance access Road within the Williamsburg Plantation Section Five located in James City County, Virginia. The structural section for Maintenance access Road is tabulated below.

LOCATION	PAVEMENT STRUCTURAL SECTION
District Park, Entrance Road	Compacted Design Subgrade 8" Crushed Stone Aggregate VDOT 21B

1.0 SITE OBSERVATIONS

The design subgrade was observed and reported by the grading contractor to be approximately at the final design elevations, compaction and compaction density tests were performed. The contractor placed crushed stone aggregate at the entrance from Route 199. The evaluated area is shown in the attached Figure 1. The exposed design subgrade was field classified to consist of reddish brown sandy silt (A-4) with trace clay.

The exposed design subgrade were proof rolled under the observation of an experienced Geotechnical Engineer with FES using a fully-loaded, tandem truck [dual axle with approximate gross weight of 25 tons]. Two (2) overlapping passes were made by the truck over the explored graded areas. In general, the result of these testing procedures indicated that the exposed design subgrade to be stable.

The existing Earthen Dam Evaluation Report, prepared by Foundation Engineering Science, Inc. (FES) for the subject project [FES Report No. 1-9C120.115, dated February 21, 2000] was reviewed. The soils encountered during our site observation appeared to generally be consistent with the soils described within the subsurface exploration study report.

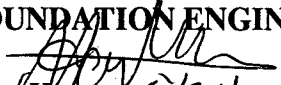
2.0 CONCLUSIONS AND RECOMMENDATIONS

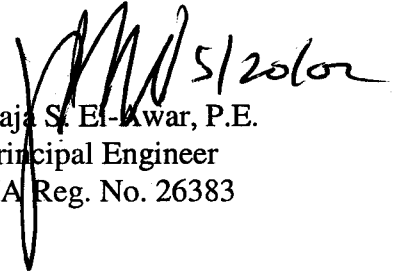
Based on the results of the proof roll [stability test], our site observations and review of the project plans and VDOT specifications, the following conclusions and recommendations are presented.

1. The design subgrade material was stable and ready for placement of crushed stone aggregate in general accordance with the project plans and VDOT specifications.
2. The top six (6) inches of the design subgrade and crushed stone aggregate layer should be compacted to a minimum dry density of 100.0 percent of the theoretical and/or laboratory maximum dry density and to full depth. A minimum of two (2) bulk samples will be obtained from the crushed stone aggregate VDOT Type 21B, and one (1) sample per (500) tons placed on this project for the performance of classification gradation testing.
3. The subgrade materials are moisture sensitive; in this regard, a re-evaluation of the subgrade materials should be performed if this material is exposed to weather effects (such as significant rainfall). This re-evaluation will consist of performing an additional inspection by an experienced professional Geotechnical Engineer or their representative to determine if the subgrade has deteriorated due to excessive moisture and/or is still capable of supporting the proposed and proposed traffic loads.

FES appreciates the opportunity to be of service to **Williamsburg Plantation, Inc.** on this important project and looks forward to its successful completion. Should you have any questions regarding this report, please do not hesitate to contact the undersigned.

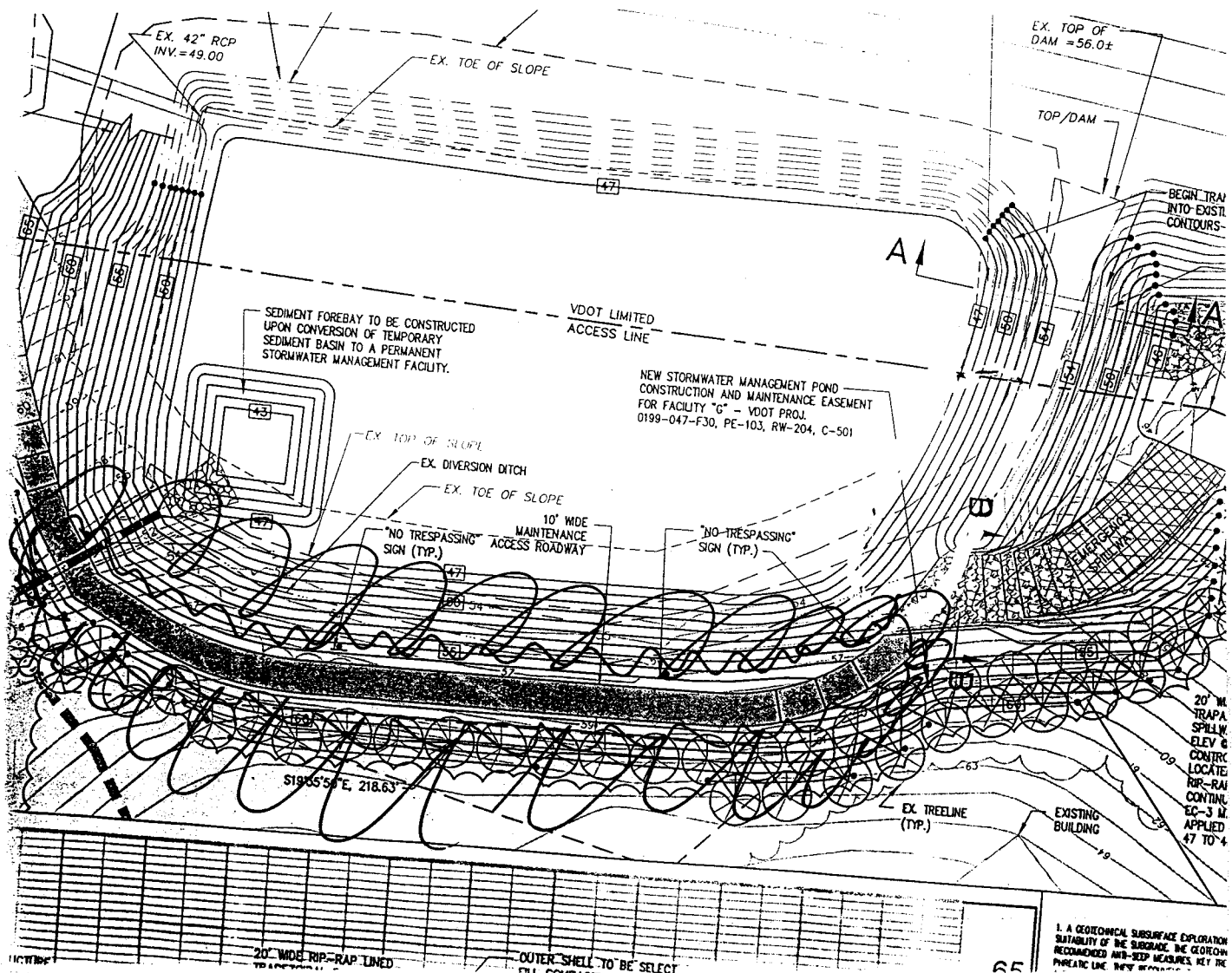
Respectfully submitted,
FOUNDATION ENGINEERING SCIENCE, INC.


Idres Hawarry 5/20/02
Project Engineer


Raja S. El-Awar, P.E.
Principal Engineer
VA Reg. No. 26383

Attachments: Figure 1 –Dam Sub-grade soils Evaluation Location Sketch

XCopies: (1) Bush Companies-Plantation Group, LLC - Mr. Ken Yerby
(1) James City County – Mr. Gerald E. Lewis
(1) VDOT – Mr. Mark D. Yeatts
(1) George Nice & Sons, Inc. – Mr. Ray Nice, P.E.
(1) AES Consulting Engineers – Mr. Richard Costello, P.E.



FOUNDATION ENGINEERING SCIENCE, INC.
 GEOTECHNICAL, ENVIRONMENTAL & CONSTRUCTION INSPECTION

11843-B CANON BOULEVARD
 NEWPORT NEWS, VIRGINIA 23606
 PHONE: 757-873-4113 FAX: 757-873-4114
 EMAIL: RELAWAR@FESVA.COM

CONSTRUCTION INSPECTION SERVICES
WILLIAMSBURG PLANTATION, SECTION
FIVE - EARTHEN DAM

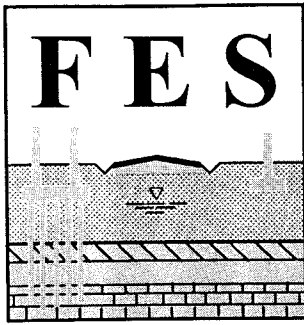
JAMES CITY COUNTY, VIRGINIA

DATE:
 MAY 15, 2002

SCALE:
 N/A

FES REPORT NO.
 1-9C120.344

FIGURE - 1
MAINTENANCE ACCESS ROAD DESIGN
SUBGRADE EVALUTION LOCATION
SKETCH



FOUNDATION ENGINEERING SCIENCE, INC.

- Geotechnical Engineering [Drilling; Foundation, Retaining Wall & Pavement Design]
- Environmental Management [Phase I & II, Asbestos and Lead Paint Sampling]
- Construction Materials Testing & Inspection [Quality Control & Quality Assurance]
- Foundation & Pavement Problems Evaluations & Remediations
- Value Engineering During Design & Construction



May 13, 2002

Mr. J.P. Ottino III, V.P.
Williamsburg Plantation, Inc.
Berkeley South Building
Executive Suite 121
3015 N. Ocean Boulevard
Ft. Lauderdale, Florida 33308

Re: Seepage and Erosion of Dam Surface Slopes Report
Williamsburg Plantation - Section Five, Earthen Dam
James City County, Virginia
FES Report No. 1-9C120.337

Dear Mr. Ottino:

Pursuant to the contractor's request, an experienced Professional Geotechnical Engineer with Foundation Engineering Science, Inc. (FES) visited the project site on May 3, 2002. The specific purpose of this site visit was to re-evaluate the side slopes of the cut areas within the recently re-constructed storm water management detention basin (SWMB) and earthen dam located within Williamsburg Plantation -Section Five in James City County, Virginia. The western portion of the cut slopes within the SWMB are three (3) horizontal to one (1) vertical [3H:1V].

A severe storm swept the area the night before on May 2, 2002, which yielded approximately two (2) inches of rain within a short period of time from approximately ten (10) pm to approximately four (4) am.

1.0 SITE OBSERVATIONS

The re-evaluated west side cut slopes of the SWMB appeared to have dried following the rain fall event that occurred on May 1, 2002 and seepage from a portion of the western cut slopes appeared to have ceased.

The side slopes appeared to be intact with exception of the areas containing severe surface water run off. The surface erosion appeared to be slight [less than three (3) to six (6) inches in depth]. The majority of the existing ground surfaces above the western and north western portion of the SWMB are higher and drain towards the SWMB. A severe erosion occurred on May 2, 2002 at the manhole located at the north end of the SWMB. The earthwork contractor repaired this erosion.

The Existing Earthen Dam Evaluation Report, prepared by Foundation Engineering Science, Inc. (FES) for the subject project [FES Report No. 1-9C120.115, dated February 21, 2000] was reviewed. The soils encountered during our site observation appeared to generally be consistent with the soils described within the subsurface exploration study report. **However, a subsurface exploration or a geotechnical engineering study was not requested or performed for the SWMB.**

11843-B CANON BOULEVARD ► NEWPORT NEWS, VIRGINIA 23606 ►PHONE: (757) 873-4113 FAX: (757) 873-114

2.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the results of our site observations, engineering judgment and extensive knowledge with similar soils, the following conclusions and recommendations are presented.

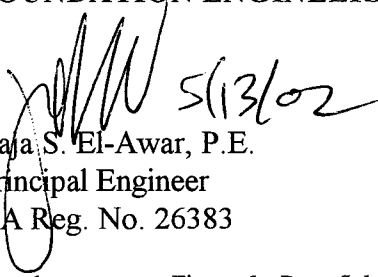
1. The cut side slopes located at the western portion of the SWMB appear to be stable with limited erosion. However, the slopes at the north and north western portion of the SWMB and specifically around the recently constructed manhole appear to have experienced severe erosion. The slopes at the north western portion of the SWMB have been repaired by the earthwork contractor.
2. Seepage and surface run off will always occur at this SWMB due to its location and the type of soils encountered on this project site.
3. Seepage from the cut slopes cannot be prevented; however, the erosion capability of this seepage could become severe if not treated or stabilized. Due to the cut slopes requiring placement of topsoil and seeding and being 3H:1V, **FES does not recommend stabilizing these slopes at this time. However, these slopes should be observed during the warranty period to insure stability is permanent.**
4. **If during the construction and warranty period these slopes experience erosion, the earthwork contractor should be directed to stabilize these slopes with a permanent stabilizing erosion geotextile engineered product. A permanent stabilizing mat such as VDOT EC-3 type geotextile engineered product to prevent severe erosion from occurring could be utilized.**
5. Surface erosion can be controlled by directing the surface run off during severe and extended rain fall events to specific areas that are not detrimental to the SWMB or the earthen dam. Surface run off should be directed from the western and north western portion of the SWMB by constructing surface ditches that are stabilized with VDOT type EC-3 geotextile engineered products.
6. The roadway portion of the SWMB appeared to experience some erosion. In this regard, FES recommends constructing drainage ditches along the western portion of this roadway and directed to a catch basin or over the over flow structure of the earthen dam.
7. FES should be present on site during installation of the geotextile engineered product to insure proper placement by the earthwork contractor.

*Seepage and Erosion of Dam Surface Slopes Report
Williamsburg Plantation Section Five, Earthen Dam
James City County, Virginia
FES Report No. 1-9C120.340*

FES appreciates the opportunity to be of service to **Williamsburg Plantation, Inc.** on this important project and looks forward to its successful completion. If you have any questions in regards to our report, please do not hesitate to contact the undersigned.

Respectfully Submitted,

FOUNDATION ENGINEERING SCIENCE, INC.


Raja S. El-Awar, P.E.
Principal Engineer
VA Reg. No. 26383

Attachments: Figure 1 –Dam Sub-grade soils Evaluation Location Sketch

XCopies:

- (1) Bush Companies – Plantation Group, LLC - Mr. Ken Yerby*
- (1) James City County – Mr. Gerald E. Lewis*
- (1) VDOT – Mr. Mark D. Yeatts*
- (1) George Nice & Sons, Inc. – Mr. Ray Nice, P.E.*
- (1) AES Consulting Engineers – Mr. Richard Costello, P.E.*

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FOUNDATION ENGINEERING SCIENCE, INC.

11843 B Canon Boulevard
Newport News, Virginia 23606
Telephone (757) 873-4113 Fax (757) 873-4114 email: relawar@fesva.com

CONCRETE FIELD INSPECTION REPORT¹

Page 1 of 2

Project Name				Williamsburg Plantation, Section Five, Earthen Dam				Project No.		1-9C120.329				
Client & Address				The Bush Companies 4029 Ironbound Road, Suite 200 Williamsburg, Virginia 23188				Date		April 17, 2002				
				Weather		Sunny		General Contractor		The Bush Companies				
				Concrete Contractor		U.S. & H. Company, Inc.								
				FES Representative		LS								
Project Location				James City County, Virginia				FES observed the placement of 6 cubic yards of 3000 psi concrete (Mix ID 30-111) delivered to the project by Custom Concrete.						
Set No.	No. of Cyl.	Time Made	Ticket Number	Truck Number	Batch Time	Time Placed	Air Temp (F)	Conc. Temp ² (F)	Air ³ (%)	Water (Gal.)	Slump ⁴ (in.)	Total Concrete Placed (c.y.)	Location	
I	5	4:10	994485	169	3:30	4:30	91	85	4.0	N/A	4.0	6.0	Concrete Cradle Slab	
SPECIFICATION REQUIREMENTS														
No. of Cylinders		5/50 yds.		Slump (in.)		4 ± 1		Air (%)		4.0		Strength at 28 days (psi)		3000
Comments:														
Concrete is sampled in accordance with ¹ ASTM C31, ² ASTM C1064, ³ ASTM C231, ⁴ ASTM C143														
Concrete molds conform to ASTM C470 requirements.														

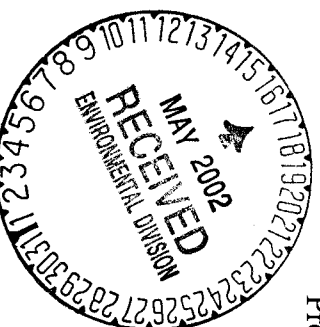
Respectfully submitted,

Idres Hawary
Idres Hawary
Project Engineer

David L. Doran
David L. Doran, E.I.T.
Project Engineer

X Copies:

- (1) Bush Companies – Plantation Group, LLC - Mr. Ken Yerby
- (1) James City County – Mr. Gerald E. Lewis
- (1) VDOT – Mr. Mark D. Yeatts
- (1) George Nice & Sons, Inc. – Mr. Ray Nice, P.E.
- (1) AES Consulting Engineers – Mr. Richard Costello, P.E.



FOUNDATION ENGINEERING SCIENCE, INC.

11843 B Canon Boulevard

Newport News, Virginia 23606

Telephone (757) 873-4113 Fax (757) 873-4114

CONCRETE COMPRESSIVE STRENGTH TEST REPORT¹**Page 2 of 2**

Client.	The Bush Companies 4029 Ironbound Road, Suite 200 Williamsburg, Virginia 23188	Report Date	April 24, 2002
Project Name	Williamsburg Plantation, Section Five, Earthen Dam	Project No	1-9C120.329
Project Location	James City County, Virginia	Set ID	I (A,B,C,D,E)
General Contractor	The Bush Companies	Mix ID	30-111
Date Sampled	April 17, 2002	Design Strength (psi)	3000
Date Received	April 18, 2002	Admixture	

FIELD TEST DATA

Supplier	Custom Concrete	Truck No.	169	Ticket No.	994485
Batch Time	3:30	Sample Time	4:10	Time Placed	4:30
Concrete Temp ² (F)	85	Air Temp (F)	91	Weather	Sunny
Slump ³ (in.)	4.0	Air Content ⁴ (%)	4.0	Unit Wt. ⁵ (pcf)	144
Water Added (gal)	N/A	Qty. Rep. (yd ³)	6	Sampled by ⁶	LS
Placement Location	Concrete Cradle Slab				

LABORATORY TEST RESULTS

SAMPLE ID NUMBER	DIA. (in.)	AREA (sq. in.)	TEST DATE	AGE (days)	MAX. LOAD (lbs.)	UNIT WT. (pcf)	COMP. STRENGTH (psi)	BREAK TYPE	TESTED BY
12519	5.97	27.99	4-24-02	7	100,000	144	3570	D	BS
12526	5.95	27.81	4-24-02	7	90,000		3240	D	BS
12521			5-15-02	28					
12522			5-15-02	28					
12523				SP					

Break Type: A-Cone, B-Cone & Split, C-Cone & Shear, D-Shear, E-Columnar

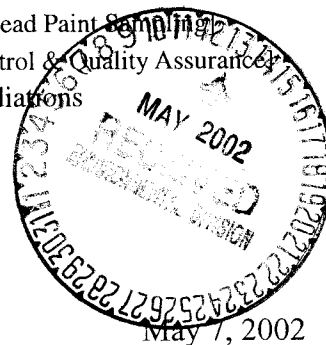
Break Type: A Cone, B Cone & Split, C Cone & Break, D Cone & Break,								
Non-Compliance	Temp		Slump		Air		Time	
Corrections Made	Temp		Slump		Air		Time	
Sample Defects	None		Curing Temp (F)		71		Humidity (%)	100
Remarks								

Concrete is sampled in accordance with ¹ASTM C39, ²ASTM C1064, ³ASTM C143, ⁴ASTM C231, ⁵ASTM C138, ⁶ASTM C31
Concrete molds conform to ASTM C470 requirements.



FOUNDATION ENGINEERING SCIENCE, INC.

- Geotechnical Engineering [Drilling; Foundation, Retaining Wall & Pavement Design]
- Environmental Management [Phase I & II, Asbestos and Lead Paint Sampling]
- Construction Materials Testing & Inspection [Quality Control & Quality Assurance]
- Foundation & Pavement Problems Evaluations & Remediations
- Value Engineering During Design & Construction



Mr. J.P. Ottino III, V.P.
Williamsburg Plantation, Inc.
Berkeley South Building
Executive Suite 121
3015 N. Ocean Boulevard
Ft. Lauderdale, Florida 33308

Re: Seepage and Erosion of Dam Surface Slopes Report
Williamsburg Plantation - Section Five, Earthen Dam
James City County, Virginia
FES Report No. 1-9C120.337

Dear Mr. Ottino:

Pursuant to the contractor's request, an experienced Professional Geotechnical Engineer with Foundation Engineering Science, Inc. (FES) visited the project site on May 3, 2002. The specific purpose of this site visit was to **evaluate the side slopes of the cut areas within the recently re-constructed storm water management detention basin (SWMB) and earthen dam located within Williamsburg Plantation -Section Five in James City County, Virginia.** The western portion of the cut slopes within the SWMB are three (3) horizontal to one (1) vertical [3H:1V].

A severe storm swept the area the night before on May 2, 2002, which yielded approximately two (2) inches of rain within a short period of time from approximately ten (10) pm to approximately four (4) am.

1.0 SITE OBSERVATIONS

The evaluated west side cut slopes of the SWMB appeared to have been soaked with this rainfall event including surface run off water from the western portion adjacent areas to the SWMB. Seepage was evident at two (2) locations from an approximate elevation of three (3) to four (4) feet above the pool existing elevation. The areas appearing to contain ground water seepage ranged approximately in length from ten (10) to thirty (30) feet. The seepage appeared to occur in water bearing or pervious layers of cohesionless soils.

The side slopes appeared to be intact with exception of the areas containing severe surface water run off. The surface erosion appeared to be slight [less than three (3) to six (6) inches in depth]. The majority of the existing ground surfaces above the western and north western portion of the SWMB are higher and drain towards the SWMB. A severe erosion occurred at the manhole located at the north end of the SWMB.

The Existing Earthen Dam Evaluation Report, prepared by Foundation Engineering Science, Inc. (FES) for the subject project [FES Report No. 1-9C120.115, dated February 21, 2000] was reviewed. The soils encountered during our site observation appeared to generally be consistent with the soils described within the subsurface exploration study report. **However, a subsurface exploration or a geotechnical engineering study was not requested or performed for the SWMB.**

2.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the results of our site observations, engineering judgment and extensive knowledge with similar soils, the following conclusions and recommendations are presented.

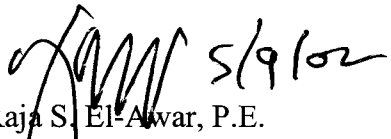
1. The cut side slopes located at the western portion of the SWMB appear to be stable with limited erosion. However, the slopes at the north and north western portion of the SWMB and specifically around the recently constructed manhole appear to have experienced severe erosion.
2. Seepage and surface run off will always occur at this SWMB due to its location and the type of soils encountered on this project site.
3. Seepage from the cut slopes cannot be prevented; however, the erosion capability of this seepage could become severe if not treated or stabilized. In this regard, FES recommends placement of a permanent stabilizing mat such as VDOT EC-3 type geotextile engineered product to prevent severe erosion from occurring due to seepage. Following completion of the seeding and placement of the geotextile engineered product, insure that grass is growing properly.
4. Surface erosion can be controlled by directing the surface run off during severe and extended rain fall events to specific areas that are not detrimental to the SWMB or the earthen dam. Surface run off should be directed from the western and north western portion of the SWMB by constructing surface ditches that are stabilized with VDOT type EC-3 geotextile engineered products.
5. The roadway portion of the SWMB appeared to experience some erosion. In this regard, FES recommends constructing drainage ditches along the western portion of this roadway and directed to a catch basin or over the over flow structure of the earthen dam.
6. FES should be present on site during installation of the geotextile engineered product to insure proper placement by the earthwork contractor.

*Seepage and Erosion of Dam Surface Slopes Report
Williamsburg Plantation Section Five, Earthen Dam
James City County, Virginia
FES Report No. 1-9C120.337*

FES appreciates the opportunity to be of service to **Williamsburg Plantation, Inc.** on this important project and looks forward to its successful completion. If you have any questions in regards to our report, please do not hesitate to contact the undersigned.

Respectfully Submitted,

FOUNDATION ENGINEERING SCIENCE, INC.


Raja S. El-Awar, P.E.
Principal Engineer
VA Reg. No. 26383

Attachments: Figure 1 –Dam Sub-grade soils Evaluation Location Sketch

XCopies:

- (1) Bush Companies – Plantation Group, LLC - Mr. Ken Yerby*
- (1) James City County – Mr. Gerald E. Lewis*
- (1) VDOT – Mr. Mark D. Yeatts*
- (1) George Nice & Sons, Inc. – Mr. Ray Nice, P.E.*
- (1) AES Consulting Engineers – Mr. Richard Costello, P.E.*

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RECORD OF PHONE CONVERSATION

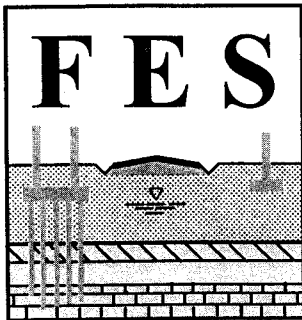
Call To: Idres Hawarry- FES Inc.

Date:5/1/02

Call By: Bob Lane

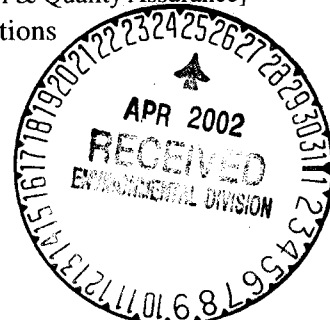
Re: FES Reports Nos. 1-9C120.313 & .314-Williamsburg Plantation Section 5
Dam Reconstruction

I called Mr Hawarry to discuss the meaning of Item 3 of the section 2.0 CONCLUSIONS AND RECOMMENDATIONS on the above noted reports. He explained that this item was intended as a reminder to the contractor that if the exposed subgrade soils were exposed to moisture, (i.e. rain over night), they would need re-evaluation prior to backfilling. He assured me that FES was present for the reconstruction of the dam and that all unsuitable subgrade soils were removed and replaced by the contractor under FES supervision.



FOUNDATION ENGINEERING SCIENCE, INC.

- Geotechnical Engineering [Drilling; Foundation, Retaining Wall & Pavement Design]
- Environmental Management [Phase I & II, Asbestos and Lead Paint Sampling]
- Construction Materials Testing & Inspection [Quality Control & Quality Assurance]
- Foundation & Pavement Problems Evaluations & Remediations
- Value Engineering During Design & Construction



April 18, 2001

Mr. J.P. Ottino III, V.P.
Williamsburg Plantation, Inc.
Berkeley South Building
Executive Suite 121
3015 N. Ocean Boulevard
Ft. Lauderdale, Florida 33308

Re: Dam - Partial Subgrade Soils Evaluation Report
Williamsburg Plantation - Section Five, Earthen Dam
James City County, Virginia
FES Report No. 1-9C120.313

Dear Mr. Ottino:

Pursuant to the contractor's request, an experienced Geotechnical Engineer with Foundation Engineering Science, Inc. (FES) visited the project site on April 16, 2002. The specific purpose of this site visit was to evaluate the cleared existing partial subgrade for the Earthen Dam located within Williamsburg Plantation - Section Five in James City County, Virginia.

1.0 SITE OBSERVATIONS

The partial existing subgrade areas of the Earthen Dam observed, appeared to have been recently cleared of existing Dam and "Topsoil" materials. The existing subgrade elevation was reported by the grading contractor to be approximately forty four (44) to forty seven (47) feet, National Geodetic Vertical Datum (NGVD) of 1929. The contractor began undercutting the key to the design elevation of thirty nine (39) feet, (NGVD). The contractor undercut the key six (6) feet in width and five (5) feet in depth. The cleared subgrade soils encountered on site consisted of gray to brown, silty sand (SM) with excessive organic matter and wood fragments. The evaluated area is shown in the attached Figure 1.

The Existing Earthen Dam Evaluation Report, prepared by Foundation Engineering Science, Inc. (FES) for the subject project [FES Report No. 1-9C120.115, dated February 21, 2000] was reviewed. The soils encountered during our site observation appeared to generally be consistent with the soils described within the subsurface exploration study report.

2.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the undercutting procedure, our site observations and engineering judgment, the following conclusions and recommendations are presented.

1. Due to the type of soils encountered within the existing subgrade for the Earthen Dam, FES representative recommended excavating the unsuitable materials. Additionally, the contractor excavated the key area to elevation thirty nine (39) feet, (NGVD) and all unsuitable materials within the existing subgrade under FES representative supervision. The approximate volume of undercut is tabulated below:

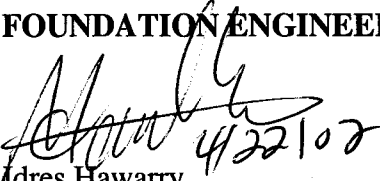
LOCATION	LENGTH (ft)	WIDTH (ft)	DEPTH (Inches)	VOLUME (Cu. Yds.)
Area No. 1	50	45	36.0	250
TOTAL = 250 Cubic Yards				

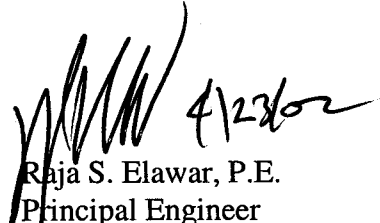
2. The excavated soils within the existing Earthen Dam and the undercut soils are unsuitable to be utilized as backfill material within the Dam or anywhere else due to containing excessive organic matter and wood fragments.
3. The subgrade soils are moisture sensitive. In this regard, following extended rainfall events or severe rainfall, we recommend the existing subgrade soils be re-evaluated by an experienced Professional Engineer or his representative to insure that the subgrade soils are stable and still capable of supporting the proposed fill and loads.

FES appreciates the opportunity to be of service to **Williamsburg Plantation, Inc.** on this important project and looks forward to its successful completion. If you have any questions in regards to our report, please do not hesitate to contact the undersigned.

Respectfully Submitted,

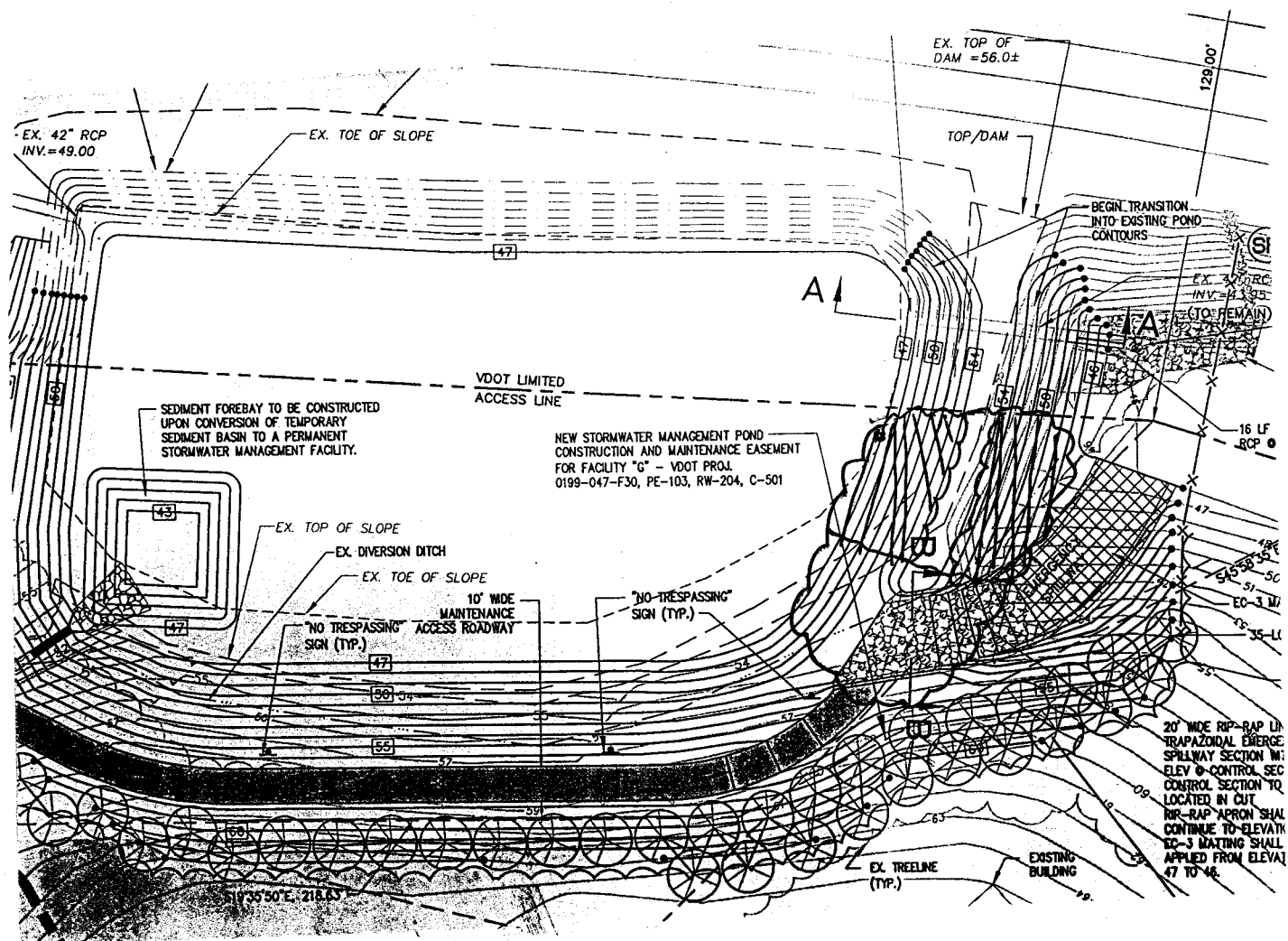
FOUNDATION ENGINEERING SCIENCE, INC.


 Andres Hawarry
 Project Engineer


 Raja S. Elawar, P.E.
 Principal Engineer
 VA Reg. No. 26383

Attachments: Figure 1 -Dam Sub-grade soils Evaluation Location Sketch

XCopies: (1) Bush Companies-Plantation Group, LLC - Mr. Ken Yerby
 (1) James City County - Mr. Gerald E. Lewis
 (1) VDOT - Mr. Mark D. Yeatts
 (1) George Nice & Sons, Inc. - Mr. Ray Nice, P.E.



-EXISTING SUBGRADE EVALUATION

-UNDERCUT AREA

FOUNDATION ENGINEERING SCIENCE, INC.
GEOTECHNICAL, ENVIRONMENTAL & CONSTRUCTION INSPECTION

11843-B CANON BOULEVARD
NEWPORT NEWS, VIRGINIA 23606
PHONE: 757-873-4113 FAX: 757-873-4114
EMAIL: RELAWAR@FESVA.COM

CONSTRUCTION INSPECTION SERVICES
WILLIAMSBURG PLANTATION, SECTION FIVE - EARTHEN DAM

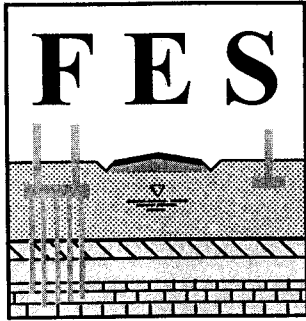
JAMES CITY COUNTY, VIRGINIA

DATE:
April 16, 2002

SCALE:
N/A

FES REPORT NO.
1-9C120.313

FIGURE - 1
EARTHEN DAM EXISTING SUBGRADE EVALUATION LOCATION SKETCH



FOUNDATION ENGINEERING SCIENCE, INC.

- Geotechnical Engineering [Drilling; Foundation, Retaining Wall & Pavement Design]
- Environmental Management [Phase I & II, Asbestos and Lead Paint Sampling]
- Construction Materials Testing & Inspection [Quality Control & Quality Assurance]
- Foundation & Pavement Problems Evaluations & Remediations
- Value Engineering During Design & Construction

Mr. J.P. Ottino III, V.P.
Williamsburg Plantation, Inc.
Berkeley South Building
Executive Suite 121
3015 N. Ocean Boulevard
Ft. Lauderdale, Florida 33308

April 19, 2001

Re: Dam - Partial Subgrade Soils Evaluation Report
Williamsburg Plantation, Section Five - Earthen Dam
James City County, Virginia
FES Report No. 1-9C120.314

Dear Mr. Ottino:

Pursuant to the contractor's request, an experienced Geotechnical Engineer with Foundation Engineering Science, Inc. (FES) visited the project site on April 17, 2002. The specific purpose of this site visit was to evaluate the cleared existing partial subgrade for the Earthen Dam located within Williamsburg Plantation - Section Five in James City County, Virginia.

1.0 SITE OBSERVATIONS

The partial existing subgrade areas of the Earthen Dam area observed, appeared to have been recently cleared of existing Dam and "Topsoil" materials. The existing subgrade elevation was reported by the grading contractor to be approximately forty four (44) to forty seven (47) feet, National Geodetic Vertical Datum (NGVD) of 1929. The contractor began undercutting the key to the design elevation of thirty nine (39) feet, (NGVD). The contractor undercut the key six (6) feet in width and five (5) feet in depth. The cleared subgrade soils encountered on site consisted of gray to brown, silty sand (SM) with wood fragments and organic matter. The evaluated area is shown in the attached Figure 1.

The existing Earthen Dam Evaluation Report, prepared by Foundation Engineering Science, Inc. (FES) for the subject project [FES Report No. 1-9C120.115, dated February 21, 2000] was reviewed. The soils encountered during our site observation appeared to generally be consistent with the soils described within the subsurface exploration study report.

2.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the undercutting procedure, our site observations and engineering judgment, the following conclusions and recommendations are presented.

1. Due to the type of soils encountered within the existing subgrade for the Earthen Dam, FES representative recommended undercutting the unsuitable materials. Additionally, the contractor excavated the key area to elevation thirty nine (39) feet (NGVD) and all unsuitable materials within the existing subgrade under FES representative supervision. The approximate volume of undercut is tabulated below:

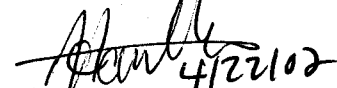
LOCATION	LENGTH (ft)	WIDTH (ft)	DEPTH (Inches)	VOLUME (Cu. Yds.)
Area No. 1	28	45	36.0	140
TOTAL = 140 Cubic Yards				

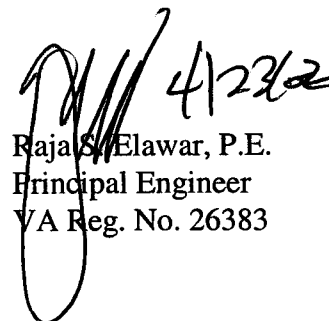
2. The excavated soils within the existing Earthen Dam and the undercut soils are unsuitable to be utilized as a backfill material within the Dam or anywhere else due to containing excessive organic matter and wood fragments.
3. The subgrade soils are moisture sensitive. In this regard, following extended rainfall events or severe rainfall, we recommend the existing subgrade soils be re-evaluated by an experienced Professional Engineer or his representative to insure that the subgrade soils are stable and still capable of supporting the proposed fill and loads.

FES appreciates the opportunity to be of service to **Williamsburg Plantation, Inc.** on this important project and looks forward to its successful completion. If you have any questions in regards to our report, please do not hesitate to contact the undersigned.

Respectfully Submitted,

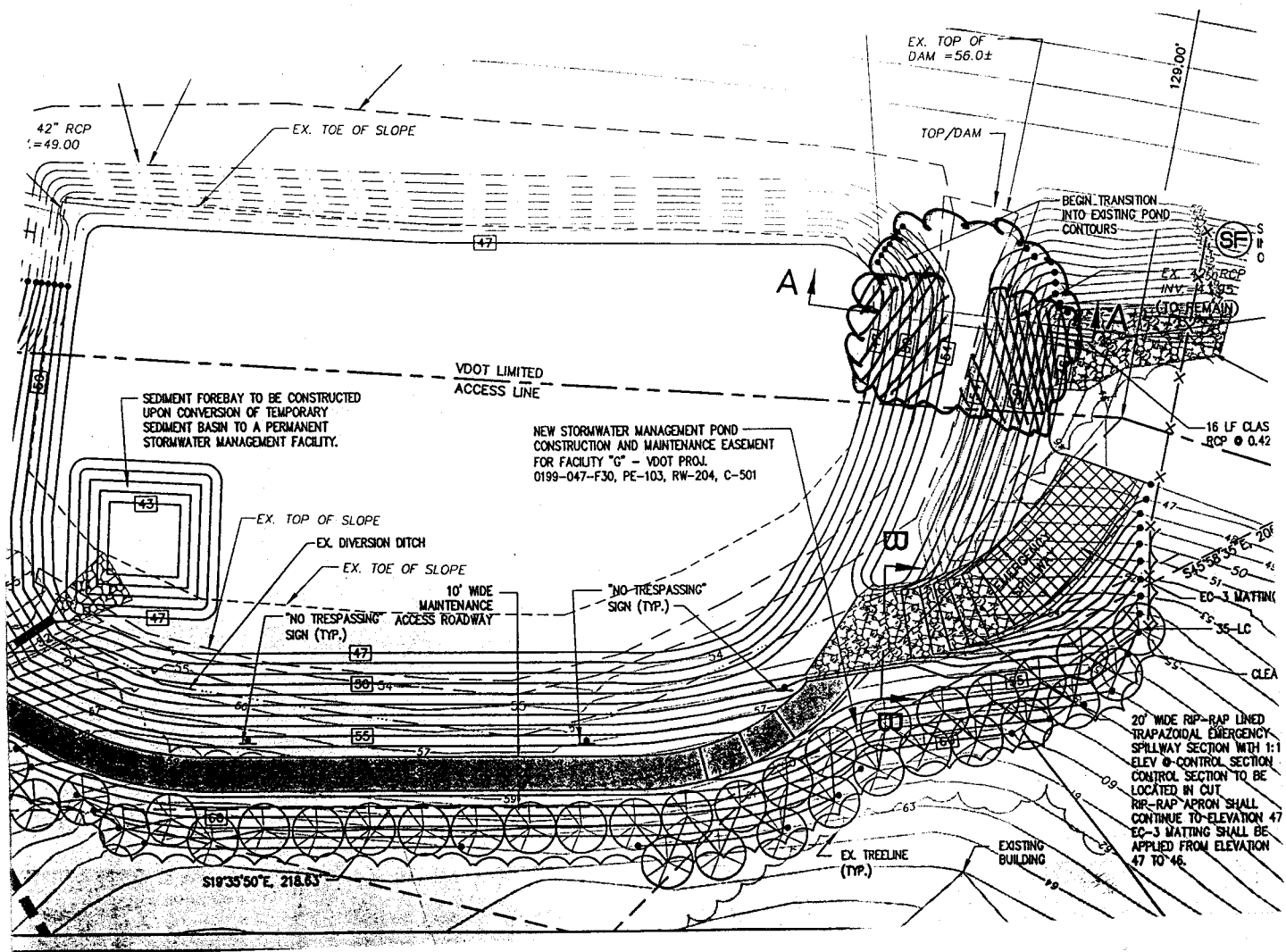
FOUNDATION ENGINEERING SCIENCE, INC.


Idres Hawarry
Project Engineer


Raja S. Elawar, P.E.
Principal Engineer
VA Reg. No. 26383

Attachments: Figure 1 -Dam Sub-grade soils Evaluation Location Sketch

XCopies: (1) Bush Companies-Plantation Group, LLC - Mr. Ken Yerby
(1) James City County - Mr. Gerald E. Lewis
(1) VDOT - Mr. Mark D. Yeatts
(1) George Nice & Sons, Inc. - Mr. Ray Nice, P.E.



**-EXISTING SUBGRADE EVALUATION
-UNDERCUT AREA**

FOUNDATION ENGINEERING SCIENCE, INC.
GEOTECHNICAL, ENVIRONMENTAL & CONSTRUCTION INSPECTION

11843-B CANON BOULEVARD
NEWPORT NEWS, VIRGINIA 23606
PHONE: 757-873-4113 FAX: 757-873-4114
EMAIL: RELAWAR@FESVA.COM

CONSTRUCTION INSPECTION SERVICES
WILLIAMSBURG PLANTATION, SECTION
FIVE - EARTHEN DAM

JAMES CITY COUNTY, VIRGINIA

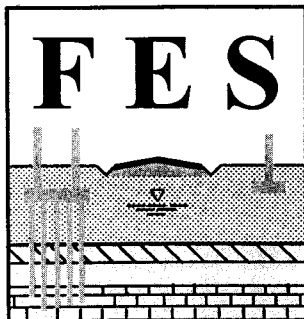
DATE:
April 17, 2002

SCALE:
N/A

FES REPORT NO.
1-9C120.314

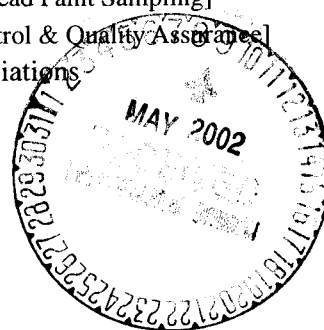
FIGURE - 1
EARTHEN DAM EXISTING SUBGRADE
EVALUATION LOCATION SKETCH

FILE:



FOUNDATION ENGINEERING SCIENCE, INC.

- Geotechnical Engineering [Drilling; Foundation, Retaining Wall & Pavement Design]
- Environmental Management [Phase I & II, Asbestos and Lead Paint Sampling]
- Construction Materials Testing & Inspection [Quality Control & Quality Assurance]
- Foundation & Pavement Problems Evaluations & Remediations
- Value Engineering During Design & Construction



May 3, 2002

Mr. J.P. Ottino III, V.P.
Williamsburg Plantation, Inc.
Berkeley South Building
Executive Suite 121
3015 N. Ocean Boulevard
Ft. Lauderdale, Florida 33308

Re: Emergency Spillway Subgrade Soils Evaluation Report
Williamsburg Plantation, Section Five - Earthen Dam
James City County, Virginia
FES Report No. 1-9C120.335

Dear Mr. Ottino:

Pursuant to the contractor's request, an experienced Geotechnical Engineer with Foundation Engineering Science, Inc. (FES) visited the project site on April 23, 2002. The specific purpose of this site visit was to evaluate the subgrade materials for the Emergency Spillway at the Earthen Dam located within Williamsburg Plantation - Section Five in James City County, Virginia.

1.0 SITE OBSERVATION

The Emergency Spillway subgrade observed appeared to have been cleared from the "Topsoil" materials and undercut twenty (20) feet in width and to the design elevation of fifty four (54) feet, National Geodetic Vertical Datum (NGVD) of 1929. The subgrade soils encountered on site consisted of gray to brown, silty sand (SM). The evaluated area is shown in the attached Figure 1.

The existing Earthen Dam Evaluation Report, prepared by Foundation Engineering Science, Inc. (FES) for the subject project [FES Report No. 1-9C120.115, dated February 21, 2000] was reviewed. The soils encountered during our site observation appeared to generally be consistent with the soils described within the subsurface exploration study report.

2.0 CONCLUSIONS AND RECOMMENDATIONS

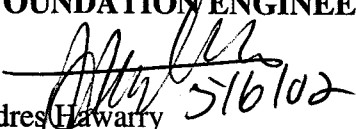
Based on the results of the undercutting procedure, our site observations and engineering judgment, the following conclusions and recommendations are presented.

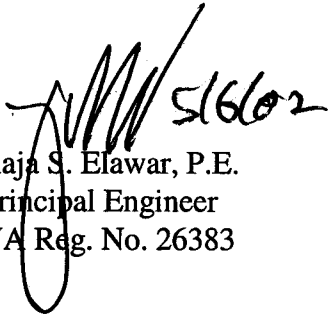
1. On-site observation indicated that the emergency spillway subgrade is ready for placement of the filter fabric liner.
2. The subgrade soils are moisture sensitive. In this regard, following extended rainfall events or severe rainfall, we recommend the existing subgrade soils be re-evaluated by an experienced Professional Engineer or his representative to insure that the subgrade soils are stable and still capable of supporting the proposed fill and loads.

FES appreciates the opportunity to be of service to **Williamsburg Plantation, Inc.** on this important project and looks forward to its successful completion. If you have any questions in regards to our report, please do not hesitate to contact the undersigned.

Respectfully Submitted,

FOUNDATION ENGINEERING SCIENCE, INC.


Idres Hawary
Project Engineer


Raja S. Elawar, P.E.
Principal Engineer
VA Reg. No. 26383

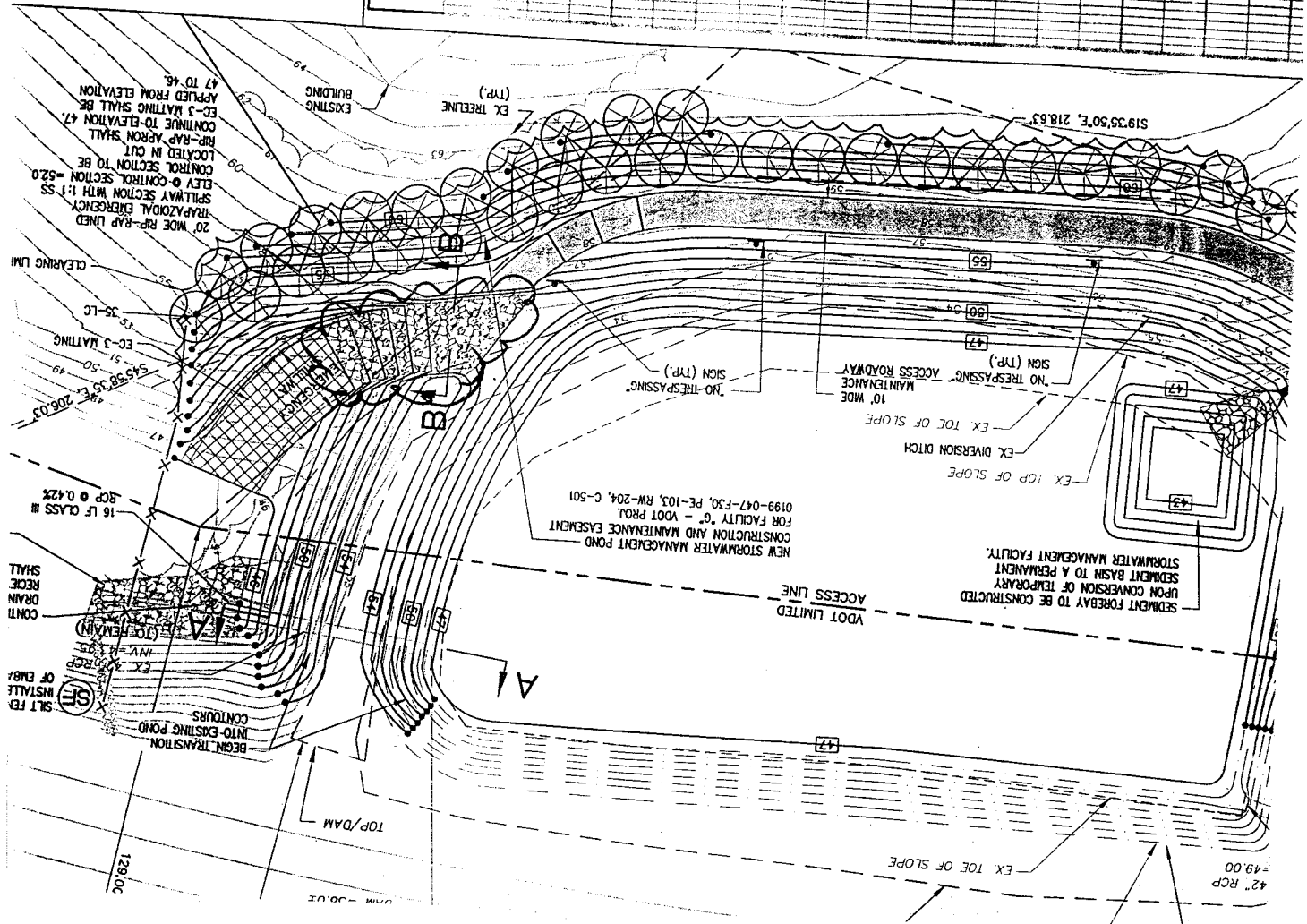
Attachments: *Figure 1 –Dam Sub-grade soils Evaluation Location Sketch*

XCopies: (1) *Bush Companies-Plantation Group, LLC - Mr. Ken Yerby*
 (1) *James City County – Mr. Gerald E. Lewis*
 (1) *VDOT – Mr. Mark D. Yeatts*
 (1) *George Nice & Sons, Inc. – Mr. Ray Nice, P.E.*
 (1) *AES Consulting Engineers – Mr. Richard Costello, P.E.*

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1. A GEOTECHNICAL SUBGRADE EVALUATION AT THE PROPOSED DAM SITE SHALL BE PERFORMED. THESE RECOMMENDATIONS ARE BASED ON THE AVAILABLE INFORMATION. THE GEOTECHNICAL INVESTIGATION WILL DETERMINE THE SATISFACTORY OF THE SUBGRADE. THE GEOTECHNICAL INVESTIGATION WILL DETERMINE THE SATISFACTORY OF THE SUBGRADE. THE GEOTECHNICAL INVESTIGATION WILL DETERMINE THE SATISFACTORY OF THE SUBGRADE.

20' WIDE RIP-RAP LINED
OUTER SLOPE TO BE SELECT



FOUNDATION ENGINEERING SCIENCE, INC.
GEOTECHNICAL, ENVIRONMENTAL & CONSTRUCTION INSPECTION

11843-B CANON BOULEVARD
NEWPORT NEWS, VIRGINIA 23606
PHONE: 757-873-4113 FAX: 757-873-4114
EMAIL: RELAWAR@FESVA.COM

CONSTRUCTION INSPECTION SERVICES
WILLIAMSBURG PLANTATION, SECTION
FIVE - EARTHEN DAM
JAMES CITY COUNTY, VIRGINIA

DATE:
April 29, 2002

SCALE:
N/A

FES REPORT NO.
1-9C120.335

FIGURE - 1
EMERGENCY SPILLWAY SUBGRADE
EVALUATION LOCATION SKETCH



FOUNDATION ENGINEERING SCIENCE, INC.

- Geotechnical Engineering [Drilling; Foundation, Retaining Wall & Pavement Design]
- Environmental Management [Phase I & II, Asbestos and Lead Paint Sampling]
- Construction Materials Testing & Inspection [Quality Control & Quality Assurance]
- Foundation & Pavement Problems Evaluations & Remediation
- Value Engineering During Design & Construction



April 30, 2002

Mr. J.P. Ottino, III, V.P.
Williamsburg Plantation, Inc.
Berkley South Building
Executive Suite 121
3015 N. Ocean Boulevard
Fort Lauderdale, Florida 33308

Re: Field Compaction Density Report
Williamsburg Plantation, Section Five, Earthen Dam
James City County, Virginia
FES Report No. 1-9C120.323

Dear Mr. Ottino:

Pursuant to the Contractor's request, a Foundation Engineering Science, Inc. (FES) representative visited the project site on April 19, 2002. The specific purpose of this visit was to perform **compaction density testing** on the on-site material placed within the earthen dam. These tests were performed in general accordance with the American Society for Testing and Materials (ASTM) Test Designation D-2922, titled "Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)".

FES appreciates the opportunity to be of service to **Williamsburg Plantation, Inc.** on this important project and looks forward to its successful completion. Should you have any questions regarding this report, please do not hesitate to contact the undersigned.

Respectfully submitted,

FOUNDATION ENGINEERING SCIENCE, INC.

Idres Hawarry
Project Engineer

David L. Doran, E.I.T.
Project Engineer

Attachments: Field Compaction Density Report
Field Compaction Density Location Sketch

XCopies: (1) Bush Companies-Plantation Group, LLC - Mr. Ken Yerby
(1) James City County - Mr. Gerald E. Lewis
(1) VDOT - Mr. Mark D. Yeatts
(1) George Nice & Sons, Inc. - Mr. Ray Nice, P.E.
(1) AES Consulting Engineers - Mr. Richard Costello, P.E.

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FOUNDATION ENGINEERING SCIENCE, INC.

11843 B Canon Boulevard

Newport News, Virginia 23606

Telephone: (757) 873-4113 Fax: (757) 873-4114

FIELD COMPACTION DENSITY REPORT¹**Page 1 of 3**

Project Name		Williamsburg Plantation, Section Five, Earthen Dam				Date		April 19, 2002			
Project No.		1-9C120.323				General Contractor		The Bush Companies			
Client		Williamsburg Plantation, Inc. Berkley South Building Executive Suite 121 3015 N. Ocean Boulevard Fort Lauderdale, Florida 33308				Earth Contractor		George Nice & Sons, Inc.			
Project Location		James City County, Virginia				Weather		Sunny			
Gauge #	26788	Model #	3430	Density Std. Ct.	3011	Moisture Std. Ct.	650	FES REP.:	LS		
Proctor	Dry Density ² (pcf)	Opt. Moist. (%)	Passing #200 ³ (%)	Material Description & Classification ⁴				Source		Compaction Requirement	
43	117.1	14.0	47.8	Reddish brown clayey SAND (SC)				On-site Borrow		Moderate effort	
TEST NO.	DEPTH (inches)	ELEVATION (feet)		PROC. NO.	D.D. (PCF)	MOIST (%)	W.D. (PCF)	% COMP	PASS	FAIL	REMARKS
1	12	46.5		43	111.3	18.2	131.4	95.0	X		
2	12	47.0		43	111.7	17.3	131.0	95.4	X		
3	6	47.0		43	111.4	17.8	131.2	95.1	X		
4	12	48.0		43	112.6	17.4	132.2	96.2	X		
5	12	48.0		43	114.6	15.5	132.3	97.9	X		
6	12	49.0		43	115.6	14.4	132.2	98.7	X		
TEST NO.		TEST LOCATION									
1		Site No. 1, See attached figure									
2		Site No. 2, See attached figure									
3		Site No. 1, See attached figure									
4		Site No. 2, See attached figure									
5		Site No. 1, See attached figure									
6		Site No. 2, See attached figure									
SPEC. REQUIREMENTS		Utility Trench		Sidewalk		Structure		Roadway/Parking		General (Dam)	
COMPACTION (%)										95.0	
MOISTURE (%)										O.M. \pm 20%	
Comments											
Compaction density testing was performed in general accordance with ¹ ASTM D2922, ² ASTM D698 (Method A), ³ ASTM D1140, ⁴ ASTM D2488 (Visual-Manual Procedure)											

FOUNDATION ENGINEERING SCIENCE, INC.

11843 B Canon Boulevard

Newport News, Virginia 23606

Telephone: (757) 873-4113 Fax: (757) 873-4114

FIELD COMPACTION DENSITY REPORT¹**Page 2 of 3**

Project Name		Williamsburg Plantation, Section Five, Earthen Dam				Date		April 19, 2002			
Project No.		1-9C120.323				General Contractor		The Bush Companies			
Client		Williamsburg Plantation, Inc. Berkley South Building Executive Suite 121 3015 N. Ocean Boulevard Fort Lauderdale, Florida 33308				Earth Contractor		George Nice & Sons, Inc.			
Project Location		James City County, Virginia				Weather		Sunny			
Gauge #	26788	Model #	3430	Density Std. Ct.	3011	Moisture Std. Ct.	650	FES REP.:	LS		
Proctor	Dry Density ² (pcf)	Opt. Moist. (%)	Passing #200 ³ (%)	Material Description & Classification ⁴				Source		Compaction Requirement	
43	117.1	14.0	47.8	Reddish brown clayey SAND (SC)				On-site Borrow		Moderate effort	
TEST NO.	DEPTH (inches)	ELEVATION (feet)		PROC. NO.	D.D. (PCF)	MOIST (%)	W.D. (PCF)	% COMP	PASS	FAIL	REMARKS
7	12	49.0		43	111.6	16.4	129.9	95.3	X		
8	12	50.0		43	111.3	16.8	130.0	95.0	X		
9	12	50.0		43	118.2	14.8	135.7	100.9	X		
10	12	51.0		43	115.7	14.3	132.2	98.8	X		
11	12	51.0		43	114.5	15.9	132.7	97.7	X		
12	12	52.0		43	115.7	14.6	132.5	98.8	X		
TEST NO.		TEST LOCATION									
7		Site No. 1, See attached figure									
8		Site No. 2, See attached figure									
9		Site No. 1, See attached figure									
10		Site No. 1, See attached figure									
11		Site No. 2, See attached figure									
12		Site No. 1, See attached figure									
SPEC. REQUIREMENTS		Utility Trench		Sidewalk		Structure		Roadway/Parking		General (Dam)	
COMPACTION (%)										95.0	
MOISTURE (%)										O.M. \pm 20%	
Comments											
Compaction density testing was performed in general accordance with ¹ ASTM D2922, ² ASTM D698 (Method A), ³ ASTM D1140, ⁴ ASTM D2488 (Visual-Manual Procedure)											

FOUNDATION ENGINEERING SCIENCE, INC.

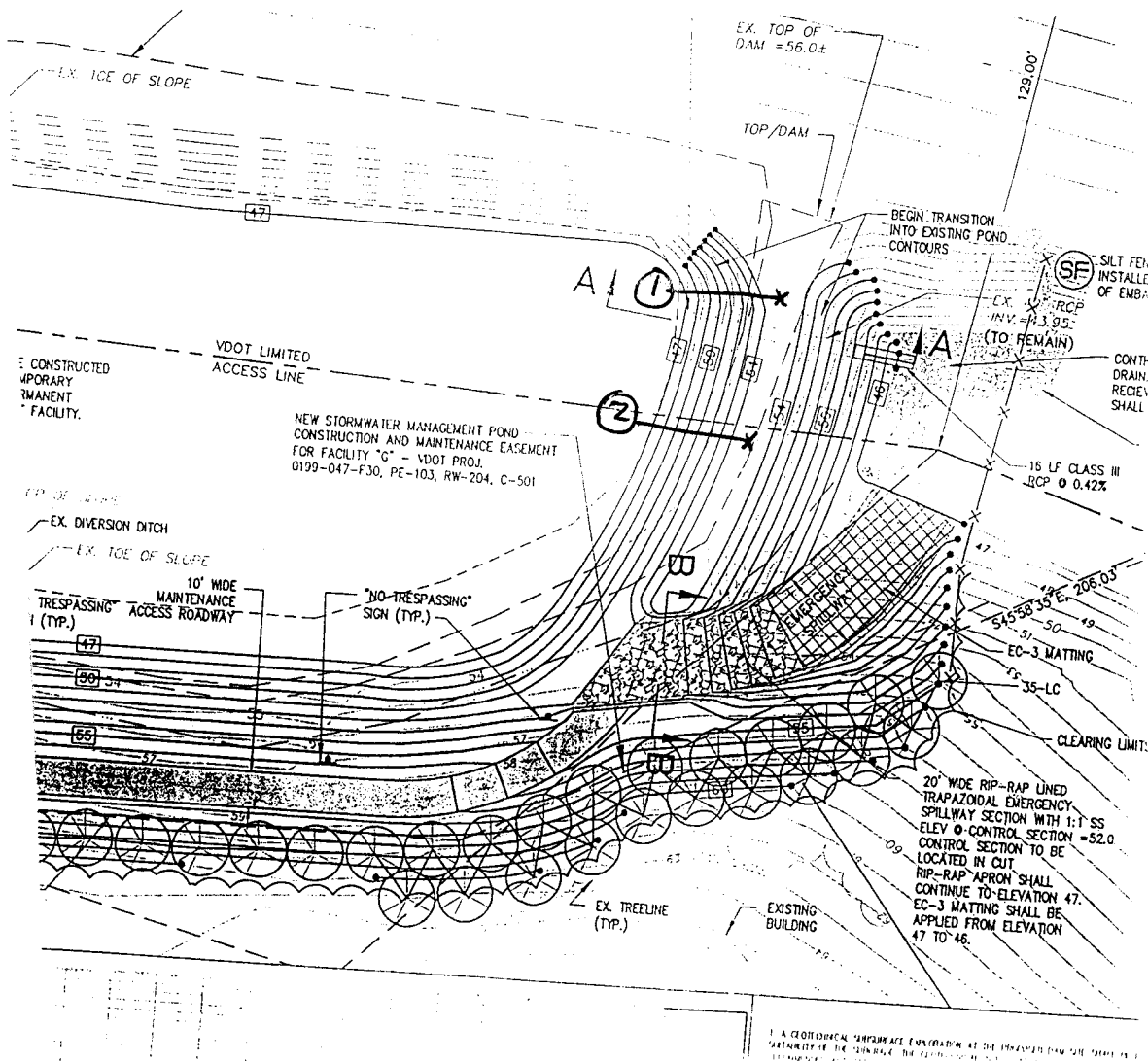
11843 B Canon Boulevard

Newport News, Virginia 23606

Telephone: (757) 873-4113 Fax: (757) 873-4114

FIELD COMPACTION DENSITY REPORT¹**Page 3 of 3**

Project Name		Williamsburg Plantation, Section Five, Earthen Dam				Date		April 19, 2002			
Project No.		1-9C120.323				General Contractor		The Bush Companies			
Client		Williamsburg Plantation, Inc. Berkley South Building Executive Suite 121 3015 N. Ocean Boulevard Fort Lauderdale, Florida 33308				Earth Contractor		George Nice & Sons, Inc.			
Project Location		James City County, Virginia				Weather		Sunny			
Gauge #	26788	Model #	3430	Density Std. Ct.	3011	Moisture Std. Ct.	650	FES REP.:	LS		
Proctor	Dry Density ² (pcf)	Opt. Moist. (%)	Passing #200 ³ (%)	Material Description & Classification ⁴				Source		Compaction Requirement	
43	117.1	14.0	47.8	Reddish brown clayey SAND (SC)				On-site Borrow		Moderate effort	
TEST NO.	DEPTH (inches)	ELEVATION (feet)		PROC. NO.	D.D. (PCF)	MOIST (%)	W.D. (PCF)	% COMP	PASS	FAIL	REMARKS
13	12	52.0		43	114.6	15.3	132.2	97.9	X		
14	12	53.0		43	116.0	17.0	135.6	98.7	X		
15	12	53.0		43	115.2	16.2	133.9	98.1	X		
16	12	54.0		43	116.1	15.6	134.2	99.2	X		
17	12	54.0		43	116.4	15.4	134.3	99.4	X		
TEST NO.	TEST LOCATION										
13	Site No. 2, See attached figure										
14	Site No. 1, See attached figure										
15	Site No. 2, See attached figure										
16	Site No. 1, See attached figure										
17	Site No. 2, See attached figure										
SPEC. REQUIREMENTS		Utility Trench		Sidewalk		Structure		Roadway/Parking		General (Dam)	
COMPACTION (%)										95.0	
MOISTURE (%)										O.M. ± 20%	
Comments											
Compaction density testing was performed in general accordance with ¹ ASTM D2922, ² ASTM D698 (Method A), ³ ASTM D1140, ⁴ ASTM D2488 (Visual-Manual Procedure)											



FOUNDATION ENGINEERING SCIENCE, INC.
GEOTECHNICAL, ENVIRONMENTAL & CONSTRUCTION INSPECTION

11843-B CANON BOULEVARD
NEWPORT NEWS, VIRGINIA 23606
PHONE: 757-873-4113 FAX: 757-873-4114
EMAIL: RELAWAR@FESVA.COM

CONSTRUCTION INSPECTION SERVICES

WILLIAMSBURG PLANTATION, SECTION FIVE - EARTHEN DAM

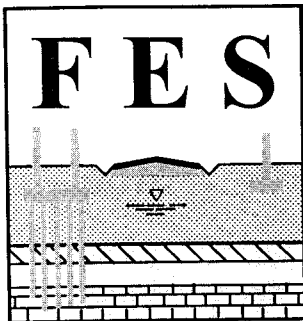
JAMES CITY COUNTY, VIRGINIA

DATE:
April 19, 2002

SCALE:
N/A

FES REPORT NO.
1-9C120.323

FIGURE - 1
FIELD DENSITY COMPACTION
LOCATION SKETCH



FOUNDATION ENGINEERING SCIENCE, INC.

- Geotechnical Engineering [Drilling; Foundation, Retaining Wall & Pavement Design]
- Environmental Management [Phase I & II, Asbestos and Lead Paint Sampling]
- Construction Materials Testing & Inspection [Quality Control & Quality Assurance]
- Foundation & Pavement Problems Evaluations & Remediations
- Value Engineering During Design & Construction



April 24, 2002

Mr. J.P. Ottino, III, V.P.
Williamsburg Plantation, Inc.
Berkley South Building
Executive Suite 121
3015 N. Ocean Boulevard
Fort Lauderdale, Florida 33308

Re: Field Compaction Density Report
Williamsburg Plantation, Section Five, Earthen Dam
James City County, Virginia
FES Report No. 1-9C120.318

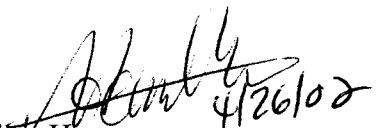
Dear Mr. Ottino:

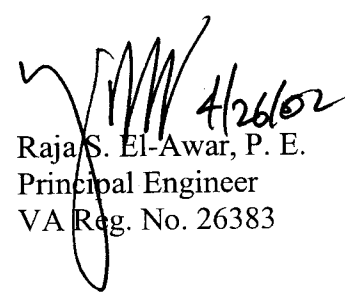
Pursuant to the Contractor's request, a Foundation Engineering Science, Inc. (FES) representative visited the project site on April 17, 2002. The specific purpose of this visit was to perform compaction density testing on the on-site material placed within the earthen dam area. These tests were performed in general accordance with the American Society for Testing and Materials (ASTM) Test Designation D-2922, titled "Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)".

FES appreciates the opportunity to be of service to **Williamsburg Plantation, Inc.** on this important project and looks forward to its successful completion. Should you have any questions regarding this report, please do not hesitate to contact the undersigned.

Respectfully submitted,

FOUNDATION ENGINEERING SCIENCE, INC.


Idres Hawarry
Project Engineer


Raja S. El-Awar, P. E.
Principal Engineer
VA Reg. No. 26383

Attachments: Field Compaction Density Report
Field Compaction Density Location Sketch

XCopies: (1) Bush Companies-Plantation Group, LLC - Mr. Ken Yerby
(1) James City County - Mr. Gerald E. Lewis
(1) VDOT - Mr. Mark D. Yeatts
(1) George Nice & Sons, Inc. - Mr. Ray Nice, P.E.

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FOUNDATION ENGINEERING SCIENCE, INC.

11843 B Canon Boulevard

Newport News, Virginia 23606

Telephone: (757) 873-4113 Fax: (757) 873-4114

FIELD COMPACTION DENSITY REPORT¹**Page 1 of 2**

Project Name		Williamsburg Plantation, Section Five, Earthen Dam				Date		April 17, 2002			
Project No.		1-9C120.318				G. Contractor		The Bush Companies			
Client		Williamsburg Plantation, Inc. Berkley South Building Executive Suite 121 3015 N. Ocean Boulevard Fort Lauderdale, Florida 33308				Earth Contractor		George Nice & Sons, Inc.			
Project Location		James City County, Virginia				Weather		Sunny			
Gauge #	26788	Model #	3430	Density Std. Ct.	3354	Moisture Std. Ct.	658	FES REP.:	LS		
Proctor	Dry Density ² (pcf)	Opt. Moist. (%)	Passing #200 ³ (%)	Material Description & Classification ⁴				Source		Compaction Requirement	
43	117.1	14.0	47.8	Reddish brown clayey SAND (SC)				On-site Borrow		Moderate effort	
TEST NO.	DEPTH (inches)	ELEVATION (feet)	PROC. NO.	D.D. (PCF)	MOIST (%)	W.D. (PCF)	% COMP	PASS	FAIL	REMARKS	
1	12	46.0	43	118.6	14.8	136.1	101.2	X			
2	12	55.0	43	119.4	14.8	137.1	102.0	X			
3	12	47.0	43	113.8	15.8	131.8	97.2	X			
4	12	56.0	43	114.7	14.9	131.8	98.0	X			
5	12	42.0	43	115.0	13.9	131.9	98.2	X			
6	12	43.0	43	117.0	14.0	132.8	99.9	X			
TEST NO.		TEST LOCATION									
1		Site No. 1, See attached figure									
2		Site No. 2, See attached figure									
3		Site No. 1, See attached figure									
4		Site No. 2, See attached figure									
5		Site No. 3, See attached figure									
6		Site No. 3, See attached figure									
SPEC. REQUIREMENTS		Utility Trench		Sidewalk		Structure		Roadway/Parking		General (Dam)	
COMPACTION (%)										95.0	
MOISTURE (%)										O.M. \pm 20%	
Comments											
Compaction density testing was performed in general accordance with ¹ ASTM D2922, ² ASTM D698 (Method A), ³ ASTM D1140, ⁴ ASTM D2488 (Visual-Manual Procedure)											

FOUNDATION ENGINEERING SCIENCE, INC.

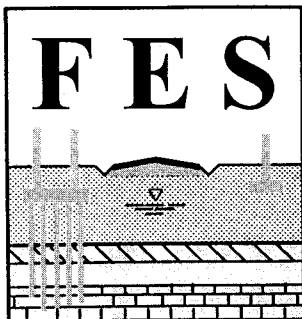
11843 B Canon Boulevard

Newport News, Virginia 23606

Telephone: (757) 873-4113 Fax: (757) 873-4114

FIELD COMPACTION DENSITY REPORT¹**Page 2 of 2**

Project Name		Williamsburg Plantation, Section Five, Earthen Dam				Date		April 17, 2002			
Project No.		1-9C120.318				G. Contractor		The Bush Companies			
Client		Williamsburg Plantation, Inc. Berkley South Building Executive Suite 121 3015 N. Ocean Boulevard Fort Lauderdale, Florida 33308				Earth Contractor		George Nice & Sons, Inc.			
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Gauge #	26788	Model #	3430	Density Std. Ct.	3354	Moisture Std. Ct.	658	FES REP.:	LS		
Proctor	Dry Density ² (pcf)	Opt. Moist. (%)	Passing #200 ³ (%)	Material Description & Classification ⁴				Source		Compaction Requirement	
43	117.1	14.0	47.8	Reddish brown clayey SAND (SC)				On-site Borrow		Moderate effort	
TEST NO.	DEPTH (inches)	ELEVATION (feet)		PROC. NO.	D.D. (PCF)	MOIST (%)	W.D. (PCF)	% COMP	PASS	FAIL	REMARKS
7	12	40.5		43	118.0	14.9	135.6	100.7	X		
8	12	41.5		43	119.6	15.0	137.5	102.1	X		
9	12	42.5		43	115.0	16.2	133.6	98.2	X		
10	12	43.5		43	120.3	15.3	138.7	102.7	X		
11	12	44.5		43	116.6	15.3	134.5	99.6	X		
12	6	45.0		43	115.6	15.8	133.8	98.7	X		
TEST NO.		TEST LOCATION									
7		Site No. 4, See attached figure									
8		Site No. 4, See attached figure									
9		Site No. 4, See attached figure									
10		Site No. 4, See attached figure									
11		Site No. 4, See attached figure									
12		Site No. 4, See attached figure									
SPEC. REQUIREMENTS		Utility Trench		Sidewalk		Structure		Roadway/Parking		General (Dam)	
COMPACTION (%)										95.0	
MOISTURE (%)										O.M. \pm 20%	
Comments											
Compaction density testing was performed in general accordance with ¹ ASTM D2922, ² ASTM D698 (Method A), ³ ASTM D1140, ⁴ ASTM D2488 (Visual-Manual Procedure)											



FOUNDATION ENGINEERING SCIENCE, INC.

- Geotechnical Engineering [Drilling; Foundation, Retaining Wall & Pavement Design]
- Environmental Management [Phase I & II, Asbestos and Lead Paint Sampling]
- Construction Materials Testing & Inspection [Quality Control & Quality Assurance]
- Foundation & Pavement Problems Evaluations & Remediations
- Value Engineering During Design & Construction

April 24, 2002

Mr. J.P. Ottino, III, V.P.
Williamsburg Plantation, Inc.
Berkley South Building
Executive Suite 121
3015 N. Ocean Boulevard
Fort Lauderdale, Florida 33308

Re: Field Compaction Density Report
Williamsburg Plantation, Section Five, Earthen Dam
James City County, Virginia
FES Report No. 1-9C120.316

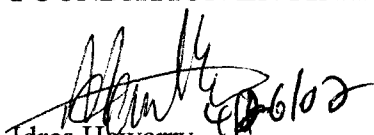
Dear Mr. Ottino:


Pursuant to the Contractor's request, a Foundation Engineering Science, Inc. (FES) representative visited the project site on April 16, 2002. The specific purpose of this visit was to perform compaction density testing on the on-site material placed within the earthen dam. These tests were performed in general accordance with the American Society for Testing and Materials (ASTM) Test Designation D-2922, titled "Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)".

FES appreciates the opportunity to be of service to **Williamsburg Plantation, Inc.** on this important project and looks forward to its successful completion. Should you have any questions regarding this report, please do not hesitate to contact the undersigned.

Respectfully submitted,

FOUNDATION ENGINEERING SCIENCE, INC.


Idres Hawarry
Project Engineer


Raja S. El-Awar, P. E.
Principal Engineer
VA Reg. No. 26383

Attachments: Field Compaction Density Report
Field Compaction Density Location Sketch

XCopies: (1) Bush Companies-Plantation Group, LLC - Mr. Ken Yerby
(1) James City County - Mr. Gerald E. Lewis
(1) VDOT - Mr. Mark D. Yeatts
(1) George Nice & Sons, Inc. - Mr. Ray Nice, P.E.

FOUNDATION ENGINEERING SCIENCE, INC.

11843 B Canon Boulevard

Newport News, Virginia 23606

Telephone: (757) 873-4113 Fax: (757) 873-4114

FIELD COMPACTION DENSITY REPORT¹**Page 1 of 2**

Project Name		Williamsburg Plantation, Section Five, Earthen Dam				Date		April 16, 2002			
Project No.		1-9C120.316				General Contractor		The Bush Companies			
Client		Williamsburg Plantation, Inc. Berkley South Building Executive Suite 121 3015 N. Ocean Boulevard Fort Lauderdale, Florida 33308				Earth Contractor		George Nice & Sons, Inc.			
Project Location		James City County, Virginia				Weather		Sunny			
Gauge #	26788	Model #	3430	Density Std. Ct.	2920	Moisture Std. Ct.	629	FES REP.:	LS		
Proctor	Dry Density ² (pcf)	Opt. Moist. (%)	Passing #200 ³ (%)	Material Description & Classification ⁴				Source		Compaction Requirement	
43	117.1	14.0	47.8	Reddish brown clayey SAND (SC)				On-site Borrow		Moderate effort	
TEST NO.	DEPTH (inches)	ELEVATION (feet)	PROC. NO.	D.D. (PCF)	MOIST (%)	W.D. (PCF)	% COMP	PASS	FAIL	REMARKS	
1	12	45.0	43	113.8	14.9	130.7	97.1	X			
2	12	41.0	43	114.1	14.8	131.0	97.5	X			
3	12	46.0	43	111.3	16.4	129.6	95.0	X			
4	12	42.0	43	116.9	15.4	135.0	99.9	X			
5	12	47.0	43	116.4	15.3	134.2	99.4	X			
6	12	43.0	43	112.7	16.0	130.8	96.3	X			
7	12	50.0	43	118.4	15.6	136.8	101.1	X			
8	12	43.5	43	113.7	16.8	132.9	97.1	X			
TEST NO.		TEST LOCATION									
1	Site No. 1, See attached figure										
2	Site No. 2, See attached figure										
3	Site No. 1, See attached figure										
4	Site No. 2, See attached figure										
5	Site No. 1, See attached figure										
6	Site No. 2, See attached figure										
7	Site No. 3, See attached figure										
8	Site No. 4, See attached figure										
SPEC. REQUIREMENTS		Utility Trench		Sidewalk		Structure		Roadway/Parking		General (Dam)	
COMPACTION (%)										95.0	
MOISTURE (%)										O.M. \pm 20%	
Comments											
Compaction density testing was performed in general accordance with ¹ ASTM D2922, ² ASTM D698 (Method A), ³ ASTM D1140, ⁴ ASTM D2488 (Visual-Manual Procedure)											

FOUNDATION ENGINEERING SCIENCE, INC.

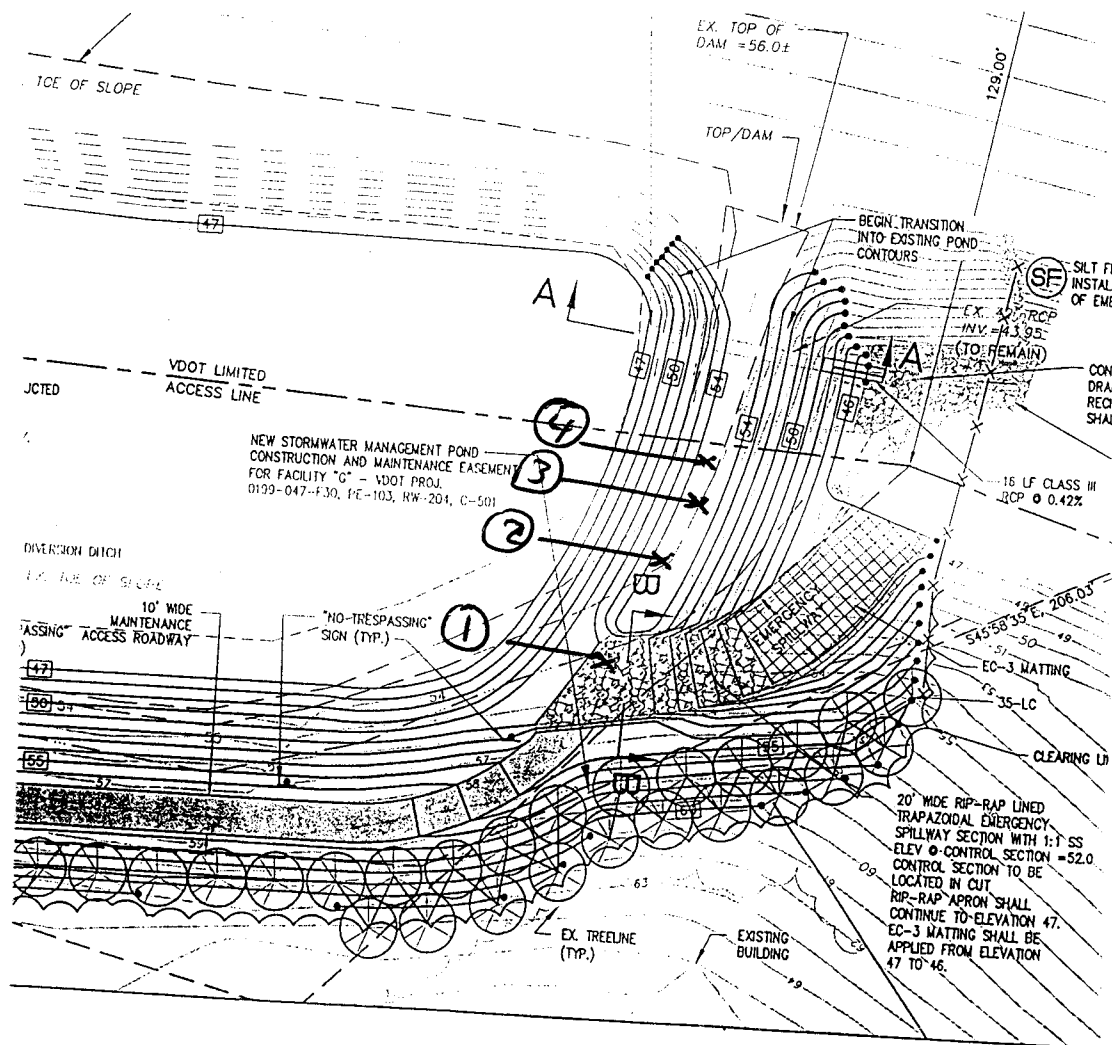
11843 B Canon Boulevard

Newport News, Virginia 23606

Telephone: (757) 873-4113 Fax: (757) 873-4114

FIELD COMPACTION DENSITY REPORT¹**Page 2 of 2**

Project Name	Williamsburg Plantation, Section Five, Earthen Dam				Date	April 16, 2002					
Project No.	1-9C120.316				General Contractor	The Bush Companies					
Client	Williamsburg Plantation, Inc. Berkley South Building Executive Suite 121 3015 N. Ocean Boulevard Fort Lauderdale, Florida 33308				Earth Contractor	George Nice & Sons, Inc.					
Project Location	James City County, Virginia				Weather	Sunny					
Gauge #	26788	Model #	3430	Density Std. Ct.	2920	Moisture Std. Ct.	629	FES REP.:	LS		
Proctor	Dry Density ² (pcf)	Opt. Moist. (%)	Passing #200 ³ (%)	Material Description & Classification ⁴				Source		Compaction Requirement	
43	117.1	14.0	47.8	Reddish brown clayey SAND (SC)				On-site Borrow		Moderate effort	
TEST NO.	DEPTH (inches)	ELEVATION (feet)		PROC. NO.	D.D. (PCF)	MOIST (%)	W.D. (PCF)	% COMP	PASS	FAIL	REMARKS
9	12	52.0		43	116.0	15.8	134.3	99.1	X		
10	12	45.0		43	112.2	16.1	130.2	95.8	X		
11	12	53.0		43	117.7	15.6	136.0	100.5	X		
12	12	46.0		43	113.8	15.5	131.4	97.1	X		
13	12	54.0		43	115.3	16.7	134.6	98.5	X		
TEST NO.	TEST LOCATION										
9	Site No. 5, See attached figure										
10	Site No. 4, See attached figure										
11	Site No. 5, See attached figure										
12	Site No. 4, See attached figure										
13	Site No. 5, See attached figure										
SPEC. REQUIREMENTS		Utility Trench		Sidewalk	Structure		Roadway/Parking		General (Dam)		
COMPACTION (%)									95.0		
MOISTURE (%)									O.M. \pm 20%		
Comments											
Compaction density testing was performed in general accordance with ¹ ASTM D2922, ² ASTM D698 (Method A), ³ ASTM D1140, ⁴ ASTM D2488 (Visual-Manual Procedure)											



FOUNDATION ENGINEERING SCIENCE, INC.
GEOTECHNICAL, ENVIRONMENTAL & CONSTRUCTION INSPECTION

11843-B CANON BOULEVARD
NEWPORT NEWS, VIRGINIA 23606
PHONE: 757-873-4113 FAX: 757-873-4114
EMAIL: RELAWAR@FESVA.COM

CONSTRUCTION INSPECTION SERVICES

WILLIAMSBURG PLANTATION, SECTION FIVE - EARTHEN DAM

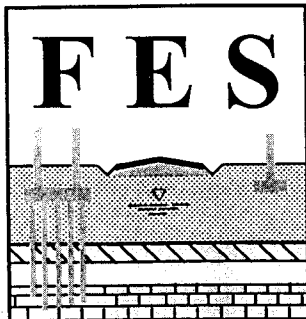
JAMES CITY COUNTY, VIRGINIA

DATE:
April 16, 2002

SCALE:
N/A

FES REPORT NO.
1-9C120.316

FIGURE - 1
FIELD DENSITY COMPACTION
LOCATION SKETCH



FOUNDATION ENGINEERING SCIENCE, INC.

- Geotechnical Engineering [Drilling; Foundation, Retaining Wall & Pavement Design]
- Environmental Management [Phase I & II, Asbestos and Lead Paint Sampling]
- Construction Materials Testing & Inspection [Quality Control & Quality Assurance]
- Foundation & Pavement Problems Evaluations & Remediations
- Value Engineering During Design & Construction

Mr. J.P. Ottino III, V.P.
Williamsburg Plantation, Inc.
Berkeley South Building
Executive Suite 121
3015 N. Ocean Boulevard
Ft. Lauderdale, Florida 33308

April 18, 2001

Re: Existing Dam Soils Evaluation Report
Williamsburg Plantation, Section Five-Earthen Dam
James City County, Virginia
FES Report No. 1-9C120.312

Dear Mr. Ottino:

Pursuant to the contractor's request an experienced Geotechnical Engineer with Foundation Engineering Science, Inc. (FES) visited the project site on April 15, 2001. The specific purpose of this visit was to evaluate the soils located at the existing Dam and determine its suitability as a backfill material for building pads and pavement areas within the Williamsburg Plantation, Section five in James City County, Virginia.

1.0 SITE OBSERVATIONS AND EVALUATIONS

The existing Dam was cleared from the "Topsoil", roots and unsuitable materials. The soils within the existing Dam was visually classified to consist of reddish brown silty sand (SM) with organic materials and woods and reddish brown clayey sand (SC) with organic materials and woods.

2.0 CONCLUSIONS AND RECOMMENDATIONS

Based on our review of the project specifications, and engineering judgement, FES offers the following conclusions and recommendations.

1. The soils within the existing Dam was evaluated and consisted of silty sand (SM) and clayey sand (SC). The silty sand (SM) and clayey sand (SC) are acceptable as backfill materials if these materials are cleared of the organic matter and woods, placed with a moisture content within ± 20 percent of the optimum moisture, the fines content [passing the No. 200 Sieve] is less than thirty-five (35) percent, compaction, moisture and stability can be achieved.

Existing Dam Soils Evaluation Report
Williamsburg Plantation, Section F1 Earthen Dam
James City County, Virginia
FES Report No. 1-9C120.312

2. Due to the contractor's excavator being down during our site visit, FES representative recommended evaluating the existing soils within the Dam during excavation operation of these materials and prior to utilizing as backfill material and performing laboratory classification testing.

FES appreciates the opportunity to be of service to **Williamsburg Plantation, Inc.** on this important project and look forward to its successful completion. Should you have any questions regarding this report, please do not hesitate to contact the undersigned.

Respectfully submitted,

FOUNDATION ENGINEERING SCIENCE, INC.

Idres Hawarry

Idres Hawarry
Project Engineer

Raja S. El-Awar 4/19/02
Raja S. El-Awar, P.E.
Principal Engineer
VA Reg. No. 26383

XCopies: (1) Bush Construction Corporation - Mr. Ken Yerby

c:\company\oldfiles\1999\cm\1-9C120.312

FOUNDATION ENGINEERING SCIENCE, INC.

11843 B Canon Boulevard
Newport News, Virginia 23606
Telephone (757) 873-4113 Fax (757) 873-4114 email: relawar@fesva.com

CONCRETE FIELD INSPECTION REPORT¹

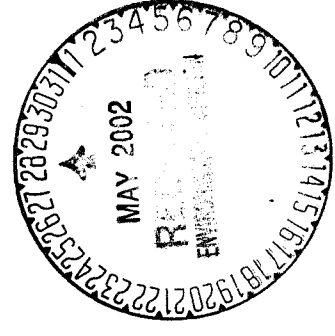
Page 1 of 2

Project Name		Williamsburg Plantation, Section Five, Earthen Dam				Project No.		1-9C120.329					
Client & Address		The Bush Companies 4029 Ironbound Road, Suite 200 Williamsburg, Virginia 23188				Date		April 17, 2002					
						Weather		Sunny					
						General Contractor		The Bush Companies					
						Concrete Contractor		U.S. & H. Company, Inc.					
Project Location		James City County, Virginia				FES Representative		LS					
FES observed the placement of 6 cubic yards of 3000 psi concrete (Mix ID 30-111) delivered to the project by Custom Concrete.													
Set No.	No. of Cyl.	Time Cyl. Made	Ticket Number	Truck Number	Batch Time	Time Placed	Air Temp (F)	Conc. Temp ² (F)	Air ³ (%)	Water (Gal.)	Slump ⁴ (in.)	Total Concrete Placed (c.y.)	Location
I	5	4:10	994485	169	3:30	4:30	91	85	4.0	N/A	4.0	6.0	Concrete Cradle Slab
SPECIFICATION REQUIREMENTS													
No. of Cylinders		5/50 yds.		Slump (in.)		4 ± 1		Air (%)		4.0		Strength at 28 days (psi)	
												3000	
Comments:													
Concrete is sampled in accordance with ¹ ASTM C31, ² ASTM C1064, ³ ASTM C231, ⁴ ASTM C143													
Concrete molds conform to ASTM C470 requirements.													

Respectfully submitted,

Idris Hawary
Idris Hawary 5/12/02
Project Engineer

David L. Doran
David L. Doran, E.I.T.
Project Engineer



- X Copies:
- (1) Bush Companies - Plantation Group, LLC - Mr. Ken Yerby
 - (1) James City County - Mr. Gerald E. Lewis
 - (1) VDOT - Mr. Mark D. Yeatts
 - (1) George Nice & Sons, Inc. - Mr. Ray Nice, P.E.
 - (1) AES Consulting Engineers - Mr. Richard Costello, P.E.

FOUNDATION ENGINEERING SCIENCE, INC.

11843 B Canon Boulevard

Newport News, Virginia 23606

Telephone (757) 873-4113 Fax (757) 873-4114

CONCRETE COMPRESSIVE STRENGTH TEST REPORT¹**Page 2 of 2**

Client	The Bush Companies 4029 Ironbound Road, Suite 200 Williamsburg, Virginia 23188	Report Date	May 15, 2002
Project Name	Williamsburg Plantation, Section Five, Earthen Dam	Project No	1-9C120.329
Project Location	James City County, Virginia	Set ID	I (A,B,C,D,E)
General Contractor	The Bush Companies	Mix ID	30-111
Date Sampled	April 17, 2002	Design Strength (psi)	3000
Date Received	April 18, 2002	Admixture	

FIELD TEST DATA

Supplier	Custom Concrete	Truck No.	169	Ticket No.	994485
Batch Time	3:30	Sample Time	4:10	Time Placed	4:30
Concrete Temp ² (F)	85	Air Temp (F)	91	Weather	Sunny
Slump ³ (in.)	4.0	Air Content ⁴ (%)	4.0	Unit Wt. ⁵ (pcf)	144
Water Added (gal)	N/A	Qty. Rep. (yd ³)	6	Sampled by ⁶	LS
Placement Location	Concrete Cradle Slab				

LABORATORY TEST RESULTS

SAMPLE ID NUMBER	DIA. (in.)	AREA (sq. in.)	TEST DATE	AGE (days)	MAX. LOAD (lbs.)	UNIT WT. (pcf)	COMP. STRENGTH (psi)	BREAK TYPE	TESTED BY
12519	5.97	27.99	4-24-02	7	100,000	144	3570	D	BS
12526	5.95	27.81	4-24-02	7	90,000		3240	D	BS
12521	5.95	27.81	5-15-02	28	125,000		4490	A	LS
12522	5.96	27.90	5-15-02	28	128,000		4580	A	LS
12523				SP					

Break Type: A-Cone, B-Cone & Split, C-Cone & Shear, D-Shear, E-Columnar

Non-Compliance	Temp		Slump		Air		Time	
Corrections Made	Temp		Slump		Air		Time	
Sample Defects	None		Curing Temp (F)		71		Humidity (%)	100
Remarks								

Concrete is sampled in accordance with ¹ASTM C39, ²ASTM C1064, ³ASTM C143, ⁴ASTM C231, ⁵ASTM C138, ⁶ASTM C31
Concrete molds conform to ASTM C470 requirements.



GEORGE NICE & SONS, INC.

- Road & Utility Construction
- Site Development

FAX

To: Bob Lane/ JCC Environmental

From: Ray Nice

Fax: 259-4032

Pages: 4

Phone:

Date: April 18, 2002

Re: Williamsburg Plantation/VDOT Joint Pond CC:

☐ Urgent ☒ For Review ☐ Please Comment ☐ Please Reply ☐ Please Recycle

• Comments:

DESIGN
INFO/
CORRESPONDENCE

Memorandum

DATE: February 18, 2002

TO: Mr. P.K. Das, Virginia Department of Transportation
Mr. Darryl Cook, James City County Environmental Division

CC: Mr. Ken Yerby, Bush Construction
Mr. Ray Nice, George Nice and Sons

FROM: Charles Records, AES Consulting Engineers *CR*

SUBJECT: Williamsburg Plantation - VDOT Joint Pond

The purpose of this memo is to address and bring closure to a few items that have been the topic of recent discussion. All of these items relate to the reconstruction of the existing VDOT stormwater management facility.

Based on our discussions and your decision, we will no longer be providing anti-seep collars for seepage control in the reconstruction of this facility. You have indicated VDOT's request to use a concrete cradle in lieu of the anti-seep collars to provide both seepage control and a better foundation for the pipe.

As proposed, the concrete cradle will extend from the existing outlet structure, which will remain, to the outfall of the 42" outlet barrel. With this proposal, the contractor will have to provide a new 42" reinforced concrete pipe (barrel) in accordance with VDOT standards and specifications for pond embankment construction. Furthermore, as the existing outlet structure for the pond will remain, so will the first joint of the pipe barrel attached to the outlet structure.

Please see the attached sketch that, with your approval, will be processed as a change order for the project.

Although it is proactive to make changes to the design of this facility before construction, it is important to note that these plans were reviewed and approved by your office before you inquired about making these changes. In an effort to expedite this change order for increasing the contractor's scope of work, we would appreciate your immediate response or approval for this design change.

If you have any questions or concerns, please feel free to contact me at 253-0040. I look forward to working with you to complete the design process of this project.



5248 Olde Towne Road • Suite 1 • Williamsburg, Virginia 23188
(757) 253-0040 • Fax (757) 220-8994 • E-mail aes@widomaker.com



AES Consulting Engineers Fax Memorandum

5248 Old Towne Road, Suite 1 • Williamsburg, Virginia 23180
Telephone: (757) 253-0040 • Facsimile: (757) 220-8994 • Email: aes@aesve.com

To: KEN YERBY, RAY NICE	Org./Firm: Bush G. NICE & Sons
Fax Number: 229 2542, SD 037	Date: 3/7/02
From: Charles Records	Pages Including Cover Page: 3
cc:	cc Fax Number:
Subject: Williamsburg Plantation / VDOT FACILITY	

☐ Urgent ☒ For Review ☐ Please Comment ☐ Please Reply

Comments:

KEN AND RAY,

ATTACHED ARE THE VDOT APPROVED
DOCUMENTS TO PROCESS THE CHANGE
ORDER FOR THE CONCRETE CRADLE.

PLEASE CALL IF YOU HAVE ANY QUESTIONS.

Thanks,

Charles Records

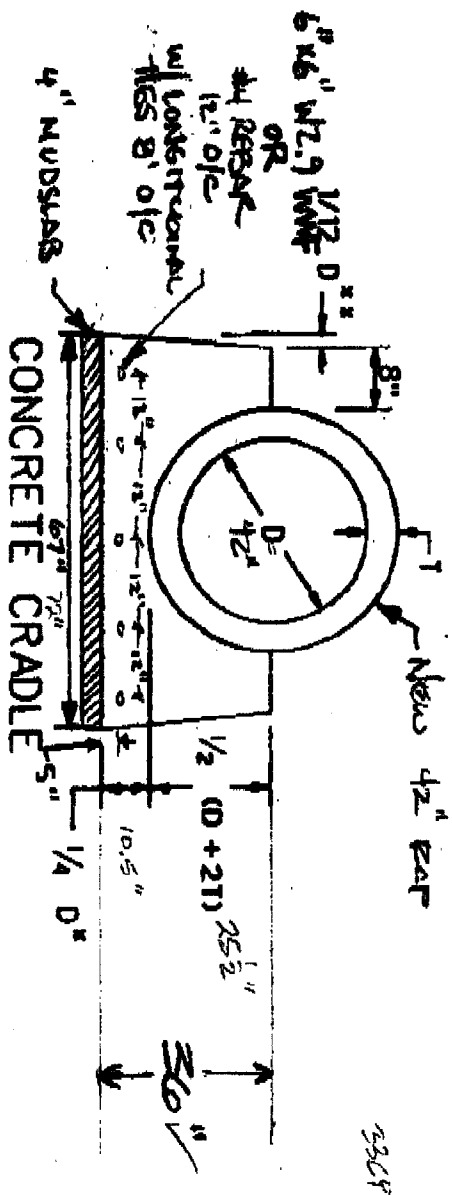
Confidentiality Note: The documents accompanying this fax may contain confidential information. This information is intended only for the use of the individual or entity named on the transmission sheet. If you are not the intended recipient, you are hereby notified that any disclosure, copying, distribution, or the taking of any action in reliance on the contents of this faxed information is strictly prohibited, and that the documents should be returned to AES Consulting Engineers. If you have received this fax in error, please notify us by telephone immediately at the number above so that we can arrange for the return of the original document at no cost to you.

* BUT NOT LESS THAN 6"

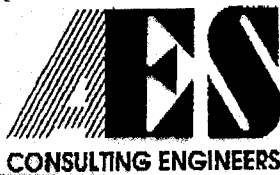
** IF THE PIPE IS LAID IN AN EXCAVATED TRENCH, THEN THE SIDE WALLS MAY CONFORM TO THE TRENCH SHAPE (IE THE TRENCH MAY BECOME THE CRADLE FORM).

CONCRETE CRADLE IS TO BE INSTALLED UNDER THE ENTIRE LENGTH OF CULVERT AT EACH STORMWATER MANAGEMENT BASIN.

CONCRETE CRADLE IS TO BE PAID FOR AS MISCELLANEOUS CONCRETE AND SUMMARIZED AS EACH PER LOCATION.



AES Consulting Group
Atty 7555-1 2/28/02
WILLIAMS RUEB PLANT 74
JOINT SUPP ROAD
74025TEL0

**AES Consulting Engineers Fax Memorandum**

5248 Olde Towne Road, Suite 1 • Williamsburg, Virginia 23188
Telephone: (757) 253-0040 • Facsimile: (757) 220-8994 • Email: aes@aesva.com

To: PK DAS, Darryl Cook	Org./Firm:
Fax Number: 253-4556, 253-0850	Date: 2/18/02
From: Charles Record	Pages Including Cover Page: 3
cc: Ken Yerby, Ray Nick	cc Fax Number: 209-2542, 565-1526
Subject:	

☐ Urgent ☐ For Review ☐ Please Comment ☐ Please Reply

Comments:

While this is a VDOT project, simply providing a concrete cradle will not prevent seepage through the dam. A gravel filter should be provided on the ~~down~~ downstream $\frac{1}{3}$ of the pipe length as it goes through the dam with the cradle provided on the first $\frac{2}{3}$'s length of the pipe. DEC 2/22/02

Confidentiality Note: The documents accompanying this fax may contain confidential information. This information is intended only for the use of the individual or entity named on the transmission sheet. If you are not the intended recipient, you are hereby notified that any disclosure, copying, distribution, or the taking of any action in reliance on the contents of this faxed information is strictly prohibited, and that the documents should be returned to AES Consulting Engineers. If you have received this fax in error, please notify us by telephone immediately at the number above so that we can arrange for the return of the original document at no cost to you.

Memorandum

DATE: February 18, 2002

TO: Mr. P.K. Das, Virginia Department of Transportation
Mr. Darryl Cook, James City County Environmental Division

CC: Mr. Ken Yerby, Bush Construction
Mr. Ray Nice, George Nice and Sons

FROM: Charles Records, AES Consulting Engineers *CR*

SUBJECT: Williamsburg Plantation - VDOT Joint Pond

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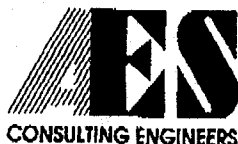
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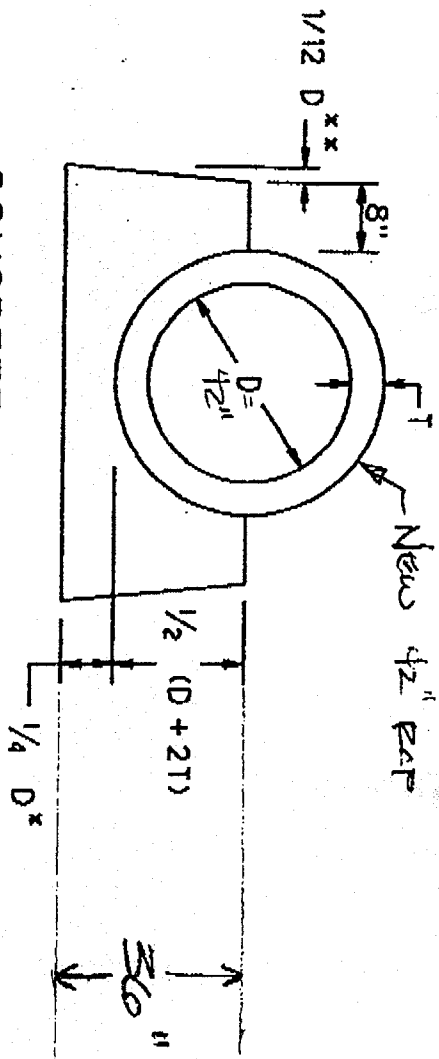
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If you have any questions or concerns, please feel free to contact me at 253-0040. I look forward to working with you to complete the design process of this project.



5248 Olde Towne Road • Suite 1 • Williamsburg, Virginia 23188
(757) 253-0040 • Fax (757) 220-8994 • E-mail aes@widomaker.com



CONCRETE CRADLE

* BUT NOT LESS THAN 6"

** IF THE PIPE IS LAID IN AN EXCAVATED TRENCH, THEN THE SIDE WALLS MAY CONFORM TO THE TRENCH SHAPE (IE THE TRENCH MAY BECOME THE CRADLE FORM).

CONCRETE CRADLE IS TO BE INSTALLED UNDER THE ENTIRE LENGTH OF CULVERT AT EACH STORMWATER MANAGEMENT BASIN.

CONCRETE CRADLE IS TO BE PAID FOR AS MISCELLANEOUS CONCRETE AND SUMMARIZED AS EACH PER LOCATION.

Note: EXISTING OUTLET STRUCTURE AND FIRST JOINT OF PIPE ATTACHED TO OUTLET STRUCTURE SHALL REMAIN.

EXISTING SWM FACILITY SEDIMENT BASIN CALCULATIONS

FOR

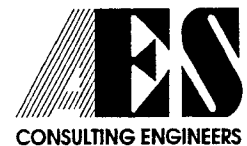
WILLIAMSBURG PLANTATION

Section 5: Units 97-133

Longhill Road
Williamsburg, Virginia 23188

Prepared By:

AES Consulting Engineers
5248 Olde Towne Road, Suite 1
Williamsburg, Virginia 23188
AES Project No. 7555-14
February 1, 2002



Hydrograph Summary Report

Page 1

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Return period (yrs)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	53.6	12	732	239,807	2	---	---	---	2 YEAR SCS POST-DE
2	SCS Runoff	114.3	12	732	511,676	10	---	---	---	10 YEAR SCS POST-D
3	SCS Runoff	130.6	12	732	586,080	25	---	---	---	25 YEAR SCS POST-D
4	SCS Runoff	206.8	12	732	937,249	100	---	---	---	100 YEAR SCS POST
6	Rational	60.3	1	25	135,682	2	---	---	---	2 yr RAT post stor
7	Rational	84.6	1	25	190,353	10	---	---	---	10 yr RAT post sto
8	Rational	97.6	1	25	219,658	25	---	---	---	25 yr RAT post sto
9	Rational	118.3	1	25	266,082	100	---	---	---	100 yr RAT post st
16	Reservoir	41.2	12	744	238,243	2	1	52.70	102,592	2yr SCS post - rou
17	Reservoir	98.2	12	744	510,111	10	2	53.54	130,451	10yr SCS post - ro
18	Reservoir	112.3	12	744	584,515	25	3	53.72	136,615	25yr SCS post - ro
19	Reservoir	143.1	12	744	935,684	100	4	55.43	203,177	100yr SCS. post-ro
21	Reservoir	38.5	1	43	123,002	2	6	52.66	101,091	2yr RAT post - rou
22	Reservoir	60.4	1	39	177,633	10	7	53.01	112,329	10yr RAT post - ro
23	Reservoir	71.8	1	38	206,923	25	8	53.18	118,111	25yr RAT post - ro
24	Reservoir	90.2	1	37	253,326	100	9	53.44	126,850	100yr RAT post -ro
								55.8 - 55.43 0.37' freebd for 100yr storm		
Proj. file: 755506DRYsedbasinform					IDFGFWJCChydrographs.IDF			Run date: 01-31-2002		

BASED ON CALCULATION TYPE USED, TOP OF DAM
WILL NEED TO BE INCREASED: SCS → TOP = 55.8
RAT → TOP = 55.2
THIS PROVIDES 2-FOOT FREEBOARD FROM 25-YR ELEVATION
(NO EMERGENCY SPILLWAY)

DETERMINE MODIFICATIONS NEEDED FOR EXISTING FACILITY TO FUNCTION AS SEDIMENT BASIN

→ WP. AREA = 19.06 AC

→ REQUIRED DRY VOLUME = 19.06 (67 CY/AC) = 1277 CY = 34,480 CF

@ ELEV = 50.35 PROV. VOL = 34,720 CF > 34,480 CF

→ REQUIRED WET VOLUME = 19.06 (67 CY/AC) = 1277 CY = 34,480 CF

@ ELEV = 51.65 PROV VOL = 70,510 - 34,720 = 35,790 CF > 34,480 CF

→ EXISTING OUTLET STRUCTURE HAS A 4" ORIFICE
DETERMINE DRAWDOWN TIME OF WET VOLUME

$$Q_R = C A \sqrt{2g \Delta h}$$

$$C = 0.6$$

$$g = 32.2 \text{ FT/S}^2$$

$$Q_R = 0.6 (0.0872) \sqrt{2(32.2)(.65)}$$
$$= 0.339 \text{ CFS}$$

$$\Delta h = \frac{51.65 - 50.35}{2} = 0.65$$

$$A = \pi r^2 = \pi \left(\frac{2}{12} \right)^2 = 0.0872 \text{ SF}$$

$$Q_R = \frac{35,790 \text{ CF}}{(X)_{\text{sec}}}$$

$$X = \frac{35,790 \text{ CF}}{0.339 \text{ CFS}}$$

$$= 105,575 \text{ S}$$

$$= \underline{\underline{29.3 \text{ HR}}}$$

CONCLUSION: - How is this to be raised?
- precast riser section

① RAISE PRINCIPAL SPILLWAY
TO ELEV = 51.65 FROM
ELEV = 49.33.

② RAISE Dewatering ORIFICE
ELEVATION TO 50.35 FROM
ELEV = 48.2. TEMPORARY
DEWATERING ORIFICE TO
REMAIN AS INDICATED
ON CONSTRUCTION PLANS.
(OVERALL CONFIGURATION TYPE)

Réservoir Report

Page 1

English

Reservoir No. 3 - existing basin

Pond Data

Pond storage is based on known values

Stage / Storage Table

Stage ft	Elevation ft	Contour area sqft	Incr. Storage cuft	Total storage cuft
0.00	47.85	00	0	0
2.20	50.00	00	0	24,840
3.15	51.00	00	0	51,786
4.15	52.00	00	0	80,595
5.15	53.00	00	0	111,834
6.15	54.00	00	0	146,286
7.15	55.00	00	0	184,437
8.15	56.00	00	0	227,826

Culvert / Orifice Structures

	[A]	[B]	[C]	[D]
Rise in	= 42.0	4.0	0.0	0.0
Span in	= 42.0	4.0	0.0	0.0
No. Barrels	= 1	1	0	0
Invert El. ft	= 44.14	50.35	0.00	0.00
Length ft	= 45.0	0.5	0.0	0.0
Slope %	= 0.42	0.00	0.00	0.00
N-Value	= .013	.013	.013	.000
Orif. Coeff.	= 0.60	0.60	0.60	0.00
Multi-Stage	= ----	Yes	Yes	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len ft	= 12.5	0.0	0.0	0.0
Crest El. ft	= 51.65	0.00	0.00	0.00
Weir Coeff.	= 3.00	3.00	0.00	0.00
Eqn. Exp.	= 1.50	1.50	0.00	0.00
Multi-Stage	= Yes	No	No	No

Tailwater Elevation = 45.70 ft

Note: All outflows have been analyzed under inlet and outlet control.

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Discharge cfs
0.00	0	47.85	36.72	0.00	---	---	0.00	---	---	---	0.00
0.22	2,484	48.07	45.74	0.00	---	---	0.00	---	---	---	0.00
0.44	4,968	48.29	53.25	0.00	---	---	0.00	---	---	---	0.00
0.66	7,452	48.51	59.83	0.00	---	---	0.00	---	---	---	0.00
0.88	9,936	48.73	65.75	0.00	---	---	0.00	---	---	---	0.00
1.10	12,420	48.95	71.18	0.00	---	---	0.00	---	---	---	0.00
1.32	14,904	49.17	76.22	0.00	---	---	0.00	---	---	---	0.00
1.54	17,388	49.39	80.96	0.00	---	---	0.00	---	---	---	0.00
1.76	19,872	49.61	85.42	0.00	---	---	0.00	---	---	---	0.00
1.98	22,356	49.83	89.67	0.00	---	---	0.00	---	---	---	0.00
2.20	24,840	50.00	92.82	0.00	---	---	0.00	---	---	---	0.00

Continues on next page...

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Discharge cfs
2.30	27,535	50.10	94.53	0.00	---	---	0.00	---	---	---	0.00
2.39	30,229	50.19	96.05	0.00	---	---	0.00	---	---	---	0.00
2.49	32,924	50.29	97.11	0.00	---	---	0.00	---	---	---	0.00
2.58	35,618	50.38	98.15	0.00	---	---	0.00	---	---	---	0.00
2.68	38,313	50.48	99.18	0.04	---	---	0.00	---	---	---	0.04
2.77	41,008	50.57	100.20	0.10	---	---	0.00	---	---	---	0.10
2.87	43,702	50.67	101.22	0.16	---	---	0.00	---	---	---	0.16
2.96	46,397	50.76	102.22	0.21	---	---	0.00	---	---	---	0.21
3.06	49,091	50.86	103.21	0.23	---	---	0.00	---	---	---	0.23
3.15	51,786	51.00	104.71	0.29	---	---	0.00	---	---	---	0.29
3.25	54,667	51.10	105.73	0.32	---	---	0.00	---	---	---	0.32
3.35	57,548	51.20	106.74	0.35	---	---	0.00	---	---	---	0.35
3.45	60,429	51.30	107.74	0.37	---	---	0.00	---	---	---	0.37
3.55	63,310	51.40	108.73	0.39	---	---	0.00	---	---	---	0.39
3.65	66,190	51.50	109.71	0.42	---	---	0.00	---	---	---	0.42
3.75	69,071	51.60	110.68	0.44	---	---	0.00	---	---	---	0.44
3.85	71,952	51.70	111.65	0.46	---	---	0.42	---	---	---	0.88
3.95	74,833	51.80	112.61	0.48	---	---	2.18	---	---	---	2.65
4.05	77,714	51.90	113.55	0.49	---	---	4.69	---	---	---	5.18
4.15	80,595	52.00	114.49	0.51	---	---	7.76	---	---	---	8.28
4.25	83,719	52.10	115.43	0.53	---	---	11.32	---	---	---	11.85
4.35	86,843	52.20	116.35	0.55	---	---	15.30	---	---	---	15.84
4.45	89,967	52.30	117.27	0.56	---	---	19.65	---	---	---	20.21
4.55	93,091	52.40	118.18	0.58	---	---	24.36	---	---	---	24.93
4.65	96,214	52.50	119.09	0.59	---	---	29.39	---	---	---	29.98
4.75	99,338	52.60	119.98	0.61	---	---	34.72	---	---	---	35.33
4.85	102,462	52.70	120.88	0.62	---	---	40.35	---	---	---	40.97
4.95	105,586	52.80	121.76	0.63	---	---	46.25	---	---	---	46.88
5.05	108,710	52.90	122.64	0.65	---	---	52.41	---	---	---	53.06
5.15	111,834	53.00	123.51	0.66	---	---	58.82	---	---	---	59.48
5.25	115,279	53.10	124.38	0.68	---	---	65.48	---	---	---	66.15
5.35	118,724	53.20	125.23	0.69	---	---	72.36	---	---	---	73.05
5.45	122,170	53.30	126.09	0.70	---	---	79.48	---	---	---	80.18
5.55	125,615	53.40	126.94	0.71	---	---	86.81	---	---	---	87.53
5.65	129,060	53.50	127.78	0.73	---	---	94.36	---	---	---	95.09
5.75	132,505	53.60	128.62	0.74	---	---	102.11	---	---	---	102.85
5.85	135,950	53.70	129.45	0.71	---	---	110.07	---	---	---	110.78
5.95	139,396	53.80	130.27	0.62	---	---	118.22	---	---	---	118.84
6.05	142,841	53.90	131.09	0.50	---	---	126.56	---	---	---	127.06
6.15	146,286	54.00	131.91	0.32	---	---	135.09	---	---	---	131.91
6.25	150,101	54.10	132.72	0.00	---	---	143.81	---	---	---	132.72
6.35	153,916	54.20	133.53	0.00	---	---	152.70	---	---	---	133.53
6.45	157,731	54.30	134.33	0.00	---	---	161.77	---	---	---	134.33
6.55	161,546	54.40	135.12	0.00	---	---	171.01	---	---	---	135.12
6.65	165,361	54.50	135.91	0.00	---	---	180.42	---	---	---	135.91
6.75	169,177	54.60	136.70	0.00	---	---	190.00	---	---	---	136.70
6.85	172,992	54.70	137.48	0.00	---	---	199.75	---	---	---	137.48
6.95	176,807	54.80	138.26	0.00	---	---	209.65	---	---	---	138.26
7.05	180,622	54.90	139.04	0.00	---	---	219.71	---	---	---	139.04
7.15	184,437	55.00	139.81	0.00	---	---	229.93	---	---	---	139.81
7.25	188,776	55.10	140.57	0.00	---	---	240.30	---	---	---	140.57
7.35	193,115	55.20	141.33	0.00	---	---	250.83	---	---	---	141.33
7.45	197,454	55.30	142.09	0.00	---	---	261.50	---	---	---	142.09

Continues on next page...

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Discharge cfs
7.55	201,793	55.40	142.84	0.00	---	---	272.32	---	---	---	142.84
7.65	206,132	55.50	143.59	0.00	---	---	283.28	---	---	---	143.59
7.75	210,470	55.60	144.34	0.00	---	---	294.39	---	---	---	144.34
7.85	214,809	55.70	145.08	0.00	---	---	305.64	---	---	---	145.08
7.95	219,148	55.80	145.82	0.00	---	---	317.03	---	---	---	145.82
8.05	223,487	55.90	146.55	0.00	---	---	328.56	---	---	---	146.55
8.15	227,826	56.00	147.28	0.00	---	---	340.22	---	---	---	147.28

...End

Hydrograph Report

Page 1

English

Hyd. No. 1

2 YEAR SCS POST-DEV

Hydrograph type = SCS Runoff
Storm frequency = 2 yrs
Drainage area = 39.53 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 3.50 in
Storm duration = 24 hrs

Peak discharge = 53.61 cfs
Time interval = 12 min
Curve number = 82
Hydraulic length = 0 ft
Time of conc. (Tc) = 25 min
Distribution = Type II
Shape factor = 484

Total Volume = 239,807 cuft

Hydrograph Discharge Table

Time -- Outflow (hrs cfs)

11.80	12.79
12.00	37.79
12.20	53.61 <<
12.40	40.24
12.60	24.24
12.80	10.67
13.00	8.37
13.20	6.96
13.40	6.11
13.60	5.46

...End

Hydrograph Report

Page 1

English

Hyd. No. 2

10 YEAR SCS POST-DEV

Hydrograph type = SCS Runoff
Storm frequency = 10 yrs
Drainage area = 39.53 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.80 in
Storm duration = 24 hrs

Peak discharge = 114.34 cfs
Time interval = 12 min
Curve number = 82
Hydraulic length = 0 ft
Time of conc. (Tc) = 25 min
Distribution = Type II
Shape factor = 484

Total Volume = 511,676 cuft

Hydrograph Discharge Table

Time -- Outflow (hrs cfs)	
11.60	12.70
11.80	31.89
12.00	84.46
12.20	114.34 <<
12.40	83.83
12.60	48.88
12.80	20.75
13.00	16.17
13.20	13.38
13.40	11.71

...End

Hydrograph Report

Page 1

English

Hyd. No. 3

25 YEAR SCS POST-DEV

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Drainage area = 39.53 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 6.40 in
Storm duration = 24 hrs

Peak discharge = 130.56 cfs
Time interval = 12 min
Curve number = 82
Hydraulic length = 0 ft
Time of conc. (Tc) = 25 min
Distribution = Type II
Shape factor = 484

Total Volume = 586,080 cuft

Hydrograph Discharge Table

Time -- Outflow
(hrs cfs)

11.60	15.03
11.80	37.20
12.00	97.09
12.20	130.56 <<
12.40	95.39
12.60	55.36
12.80	23.37
13.00	18.20
13.20	15.05
13.40	13.16

...End

Hydrograph Report

Page 1

English

Hyd. No. 4

100 YEAR SCS POST DEV

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Drainage area = 47.00 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 8.00 in
Storm duration = 24 hrs

Peak discharge = 206.85 cfs
Time interval = 12 min
Curve number = 82
Hydraulic length = 0 ft
Time of conc. (Tc) = 25 min
Distribution = Type II
Shape factor = 484

Total Volume = 937,249 cuft

Hydrograph Discharge Table

Time -- Outflow (hrs cfs)

11.60	25.51
11.80	61.42
12.00	155.84
12.20	206.85 <<
12.40	150.13
12.60	86.32
12.80	36.07
13.00	28.05
13.20	23.16

...End

Hydrograph Report

Page 1

English

Hyd. No. 6

2 yr RAT post storm

Hydrograph type = Rational
Storm frequency = 2 yrs
Drainage area = 39.5 ac
Intensity = 2.88 in
I-D-F Curve = JCChydrographs.IDF

Peak discharge = 60.30 cfs
Time interval = 1 min
Runoff coeff. = 0.53
Time of conc. (Tc) = 25 min
Reced. limb factor = 2

Total Volume = 135,682 cuft

Hydrograph Discharge Table

Time -- Outflow (hrs cfs)	Time -- Outflow (hrs cfs)	Time -- Outflow (hrs cfs)
0.05 7.24	0.58 48.24	1.12 9.65
0.07 9.65	0.60 47.04	1.13 8.44
0.08 12.06	0.62 45.83	1.15 7.24
0.10 14.47	0.63 44.62	1.17 6.03
0.12 16.88	0.65 43.42	
0.13 19.30	0.67 42.21	
0.15 21.71	0.68 41.01	...End
0.17 24.12	0.70 39.80	
0.18 26.53	0.72 38.59	
0.20 28.95	0.73 37.39	
0.22 31.36	0.75 36.18	
0.23 33.77	0.77 34.98	
0.25 36.18	0.78 33.77	
0.27 38.59	0.80 32.56	
0.28 41.01	0.82 31.36	
0.30 43.42	0.83 30.15	
0.32 45.83	0.85 28.95	
0.33 48.24	0.87 27.74	
0.35 50.65	0.88 26.53	
0.37 53.07	0.90 25.33	
0.38 55.48	0.92 24.12	
0.40 57.89	0.93 22.92	
0.42 60.30 <<	0.95 21.71	
0.43 59.10	0.97 20.50	
0.45 57.89	0.98 19.30	
0.47 56.69	1.00 18.09	
0.48 55.48	1.02 16.88	
0.50 54.27	1.03 15.68	
0.52 53.07	1.05 14.47	
0.53 51.86	1.07 13.27	
0.55 50.65	1.08 12.06	
0.57 49.45	1.10 10.85	

Hydrograph Report

Page 1

English

Hyd. No. 7

10 yr RAT post storm

Hydrograph type = Rational
Storm frequency = 10 yrs
Drainage area = 39.5 ac
Intensity = 4.04 in
I-D-F Curve = JCChydrographs.IDF

Peak discharge = 84.60 cfs
Time interval = 1 min
Runoff coeff. = 0.53
Time of conc. (Tc) = 25 min
Reced. limb factor = 2

Total Volume = 190,353 cuft

Hydrograph Discharge Table

Time -- Outflow (hrs cfs)	Time -- Outflow (hrs cfs)	Time -- Outflow (hrs cfs)
0.05 10.15	0.58 67.68	1.12 13.54
0.07 13.54	0.60 65.99	1.13 11.84
0.08 16.92	0.62 64.30	1.15 10.15
0.10 20.30	0.63 62.60	1.17 8.46
0.12 23.69	0.65 60.91	
0.13 27.07	0.67 59.22	
0.15 30.46	0.68 57.53	...End
0.17 33.84	0.70 55.84	
0.18 37.22	0.72 54.14	
0.20 40.61	0.73 52.45	
0.22 43.99	0.75 50.76	
0.23 47.38	0.77 49.07	
0.25 50.76	0.78 47.38	
0.27 54.14	0.80 45.68	
0.28 57.53	0.82 43.99	
0.30 60.91	0.83 42.30	
0.32 64.30	0.85 40.61	
0.33 67.68	0.87 38.92	
0.35 71.07	0.88 37.22	
0.37 74.45	0.90 35.53	
0.38 77.83	0.92 33.84	
0.40 81.22	0.93 32.15	
0.42 84.60 <<	0.95 30.46	
0.43 82.91	0.97 28.76	
0.45 81.22	0.98 27.07	
0.47 79.53	1.00 25.38	
0.48 77.83	1.02 23.69	
0.50 76.14	1.03 22.00	
0.52 74.45	1.05 20.30	
0.53 72.76	1.07 18.61	
0.55 71.07	1.08 16.92	
0.57 69.37	1.10 15.23	

Hydrograph Report

Page 1

English

Hyd. No. 8

25 yr RAT post storm

Hydrograph type = Rational
Storm frequency = 25 yrs
Drainage area = 39.5 ac
Intensity = 4.66 in
I-D-F Curve = JCChydrographs.IDF

Peak discharge = 97.63 cfs
Time interval = 1 min
Runoff coeff. = 0.53
Time of conc. (Tc) = 25 min
Reced. limb factor = 2

Total Volume = 219,658 cuft

Hydrograph Discharge Table

Time -- Outflow (hrs cfs)	Time -- Outflow (hrs cfs)	Time -- Outflow (hrs cfs)
0.05 11.72	0.58 78.10	1.12 15.62
0.07 15.62	0.60 76.15	1.13 13.67
0.08 19.53	0.62 74.20	1.15 11.72
0.10 23.43	0.63 72.24	1.17 9.76
0.12 27.34	0.65 70.29	
0.13 31.24	0.67 68.34	
0.15 35.15	0.68 66.39	...End
0.17 39.05	0.70 64.43	
0.18 42.96	0.72 62.48	
0.20 46.86	0.73 60.53	
0.22 50.77	0.75 58.58	
0.23 54.67	0.77 56.62	
0.25 58.58	0.78 54.67	
0.27 62.48	0.80 52.72	
0.28 66.39	0.82 50.77	
0.30 70.29	0.83 48.81	
0.32 74.20	0.85 46.86	
0.33 78.10	0.87 44.91	
0.35 82.01	0.88 42.96	
0.37 85.91	0.90 41.00	
0.38 89.82	0.92 39.05	
0.40 93.72	0.93 37.10	
0.42 97.63 <<	0.95 35.15	
0.43 95.67	0.97 33.19	
0.45 93.72	0.98 31.24	
0.47 91.77	1.00 29.29	
0.48 89.82	1.02 27.34	
0.50 87.86	1.03 25.38	
0.52 85.91	1.05 23.43	
0.53 83.96	1.07 21.48	
0.55 82.01	1.08 19.53	
0.57 80.05	1.10 17.57	

Hydrograph Report

Page 1

English

Hyd. No. 9

100 yr RAT post storm

Hydrograph type = Rational
Storm frequency = 100 yrs
Drainage area = 39.5 ac
Intensity = 5.64 in
I-D-F Curve = JCChydrographs.IDF

Peak discharge = 118.26 cfs
Time interval = 1 min
Runoff coeff. = 0.53
Time of conc. (Tc) = 25 min
Reced. limb factor = 2

Total Volume = 266,082 cuft

Hydrograph Discharge Table

Time -- Outflow (hrs cfs)	Time -- Outflow (hrs cfs)	Time -- Outflow (hrs cfs)
0.05 14.19	0.58 94.61	1.12 18.92
0.07 18.92	0.60 92.24	1.13 16.56
0.08 23.65	0.62 89.88	1.15 14.19
0.10 28.38	0.63 87.51	1.17 11.83
0.12 33.11	0.65 85.15	
0.13 37.84	0.67 82.78	
0.15 42.57	0.68 80.42	...End
0.17 47.30	0.70 78.05	
0.18 52.03	0.72 75.69	
0.20 56.76	0.73 73.32	
0.22 61.49	0.75 70.96	
0.23 66.22	0.77 68.59	
0.25 70.96	0.78 66.22	
0.27 75.69	0.80 63.86	
0.28 80.42	0.82 61.49	
0.30 85.15	0.83 59.13	
0.32 89.88	0.85 56.76	
0.33 94.61	0.87 54.40	
0.35 99.34	0.88 52.03	
0.37 104.07	0.90 49.67	
0.38 108.80	0.92 47.30	
0.40 113.53	0.93 44.94	
0.42 118.26 <<	0.95 42.57	
0.43 115.89	0.97 40.21	
0.45 113.53	0.98 37.84	
0.47 111.16	1.00 35.48	
0.48 108.80	1.02 33.11	
0.50 106.43	1.03 30.75	
0.52 104.07	1.05 28.38	
0.53 101.70	1.07 26.02	
0.55 99.34	1.08 23.65	
0.57 96.97	1.10 21.29	

Hydrograph Report

Page 1

English

Hyd. No. 16

2yr SCS post - routed

Hydrograph type = Reservoir
Storm frequency = 2 yrs
Inflow hyd. No. = 1
Max. Elevation = 52.70 ft

Peak discharge = 41.21 cfs
Time interval = 12 min
Reservoir name = existing basin
Max. Storage = 102,592 cuft

Storage Indication method used.

Total Volume = 238,243 cuft

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Outflow cfs
12.20	53.61 <<	52.37	117.88	0.57	----	----	22.79	----	----	----	23.37
12.40	40.24	52.70 <<	120.91	0.62	----	----	40.59	----	----	----	41.21 <<
12.60	24.24	52.58	119.79	0.60	----	----	33.58	----	----	----	34.18
12.80	10.67	52.34	117.59	0.57	----	----	21.30	----	----	----	21.87
13.00	8.37	52.15	115.85	0.54	----	----	13.12	----	----	----	13.65
13.20	6.96	52.05	114.95	0.52	----	----	9.51	----	----	----	10.03
13.40	6.11	51.99	114.41	0.51	----	----	7.49	----	----	----	8.00
13.60	5.46	51.95	114.04	0.50	----	----	6.26	----	----	----	6.77
13.80	4.93	51.92	113.77	0.50	----	----	5.39	----	----	----	5.89
14.00	4.49	51.90	113.57	0.49	----	----	4.74	----	----	----	5.23
14.20	4.10	51.88	113.40	0.49	----	----	4.28	----	----	----	4.78
14.40	3.81	51.87	113.25	0.49	----	----	3.89	----	----	----	4.38

...End

Hydrograph Report

Page 1

English

Hyd. No. 17

10yr SCS post - routed

Hydrograph type = Reservoir
Storm frequency = 10 yrs
Inflow hyd. No. = 2
Max. Elevation = 53.54 ft

Peak discharge = 98.22 cfs
Time interval = 12 min
Reservoir name = existing basin
Max. Storage = 130,451 cuft

Storage Indication method used.

Total Volume = 510,111 cuft

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Outflow cfs
11.80	31.89	52.15	115.92	0.54	----	----	13.44	----	----	----	13.97
12.00	84.46	52.80	121.72	0.63	----	----	45.99	----	----	----	46.62
12.20	114.34 <<	53.45	127.36	0.72	----	----	90.62	----	----	----	91.34
12.40	83.83	53.54 <<	128.12	0.73	----	----	97.49	----	----	----	98.22 <<
12.60	48.88	53.16	124.92	0.68	----	----	69.86	----	----	----	70.54
12.80	20.75	52.70	120.86	0.62	----	----	40.27	----	----	----	40.89
13.00	16.17	52.38	117.98	0.57	----	----	23.31	----	----	----	23.88
13.20	13.38	52.24	116.72	0.55	----	----	17.05	----	----	----	17.60
13.40	11.71	52.16	116.00	0.54	----	----	13.77	----	----	----	14.31
13.60	10.44	52.11	115.53	0.53	----	----	11.74	----	----	----	12.27
13.80	9.41	52.07	115.17	0.52	----	----	10.35	----	----	----	10.87

...End

Hydrograph Report

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English

Hyd. No. 18

25yr SCS post - routed

Hydrograph type = Reservoir
Storm frequency = 25 yrs
Inflow hyd. No. = 3
Max. Elevation = 53.72 ft

Peak discharge = 112.33 cfs
Time interval = 12 min
Reservoir name = existing basin
Max. Storage = 136,615 cuft

Storage Indication method used.

Total Volume = 584,515 cuft

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Outflow cfs
11.80	37.20	52.29	117.18	0.56	----	----	19.21	----	----	----	19.76
12.00	97.09	52.96	123.13	0.66	----	----	56.02	----	----	----	56.68
12.20	130.56 <<	53.64	128.94	0.73	----	----	105.26	----	----	----	105.98
12.40	95.39	53.72 <<	129.61	0.70	----	----	111.64	----	----	----	112.33 <<
12.60	55.36	53.29	126.00	0.70	----	----	78.78	----	----	----	79.48
12.80	23.37	52.78	121.61	0.63	----	----	45.23	----	----	----	45.86
13.00	18.20	52.43	118.45	0.58	----	----	25.82	----	----	----	26.40
13.20	15.05	52.28	117.12	0.56	----	----	18.93	----	----	----	19.49
13.40	13.16	52.20	116.36	0.55	----	----	15.34	----	----	----	15.88
13.60	11.73	52.15	115.86	0.54	----	----	13.18	----	----	----	13.72
13.80	10.57	52.11	115.49	0.53	----	----	11.57	----	----	----	12.10

...End

Hydrograph Report

Page 1

English

Hyd. No. 19

100yr SCS. post-routed

Hydrograph type = Reservoir
Storm frequency = 100 yrs
Inflow hyd. No. = 4
Max. Elevation = 55.43 ft

Peak discharge = 143.08 cfs
Time interval = 12 min
Reservoir name = existing basin
Max. Storage = 203,177 cuft

Storage Indication method used.

Total Volume = 935,684 cuft

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Outflow cfs
11.40	17.61	52.17	116.06	0.54	----	----	14.01	----	----	----	14.55
11.60	25.51	52.28	117.05	0.56	----	----	18.61	----	----	----	19.16
11.80	61.42	52.63	120.25	0.61	----	----	36.42	----	----	----	37.03
12.00	155.84	53.53	128.03	0.73	----	----	96.69	----	----	----	97.42
12.20	206.85 <<	54.78	138.07	----	----	----	207.25	----	----	----	138.07
12.40	150.13	55.43 <<	143.08	----	----	----	275.82	----	----	----	143.08 <<
12.60	86.32	55.04	140.14	----	----	----	234.47	----	----	----	140.14
12.80	36.07	53.76	129.98	0.65	----	----	115.35	----	----	----	116.00
13.00	28.05	52.74	121.26	0.63	----	----	42.92	----	----	----	43.55
13.20	23.16	52.49	119.01	0.59	----	----	28.95	----	----	----	29.54
13.40	20.24	52.38	117.97	0.57	----	----	23.25	----	----	----	23.82
13.60	18.03	52.31	117.33	0.56	----	----	19.96	----	----	----	20.52
13.80	16.23	52.25	116.86	0.55	----	----	17.68	----	----	----	18.23
14.00	14.71	52.21	116.47	0.55	----	----	15.83	----	----	----	16.38
14.20	13.42	52.18	116.13	0.54	----	----	14.35	----	----	----	14.89

...End

Hydrograph Report

Page 1

English

Hyd. No. 21

2yr RAT post - routed

Hydrograph type = Reservoir
Storm frequency = 2 yrs
Inflow hyd. No. = 6
Max. Elevation = 52.66 ft

Peak discharge = 38.49 cfs
Time interval = 1 min
Reservoir name = existing basin
Max. Storage = 101,091 cuft

Storage Indication method used.

Total Volume = 123,002 cuft

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Outflow cfs
0.42	60.30 <<	51.90	113.52	0.49	----	----	4.59	----	----	----	5.08
0.43	59.10	52.01	114.55	0.51	----	----	7.97	----	----	----	8.48
0.45	57.89	52.10	115.42	0.53	----	----	11.27	----	----	----	11.80
0.47	56.69	52.18	116.19	0.54	----	----	14.61	----	----	----	15.16
0.48	55.48	52.26	116.89	0.55	----	----	17.84	----	----	----	18.39
0.50	54.27	52.33	117.50	0.57	----	----	20.85	----	----	----	21.42
0.52	53.07	52.38	118.04	0.57	----	----	23.64	----	----	----	24.21
0.53	51.86	52.44	118.51	0.58	----	----	26.20	----	----	----	26.78
0.55	50.65	52.48	118.92	0.59	----	----	28.45	----	----	----	29.04
0.57	49.45	52.52	119.27	0.59	----	----	30.45	----	----	----	31.04
0.58	48.24	52.55	119.56	0.60	----	----	32.18	----	----	----	32.78
0.60	47.04	52.58	119.80	0.60	----	----	33.63	----	----	----	34.23
0.62	45.83	52.60	120.00	0.61	----	----	34.82	----	----	----	35.43
0.63	44.62	52.62	120.16	0.61	----	----	35.83	----	----	----	36.44
0.65	43.42	52.63	120.28	0.61	----	----	36.60	----	----	----	37.22
0.67	42.21	52.64	120.37	0.61	----	----	37.18	----	----	----	37.79
0.68	41.01	52.65	120.44	0.61	----	----	37.57	----	----	----	38.18
0.70	39.80	52.65	120.47	0.61	----	----	37.80	----	----	----	38.41
0.72	38.59	52.66 <<	120.48	0.61	----	----	37.88	----	----	----	38.49 <<
0.73	37.39	52.66	120.48	0.61	----	----	37.83	----	----	----	38.44
0.75	36.18	52.65	120.45	0.61	----	----	37.66	----	----	----	38.27
0.77	34.98	52.65	120.41	0.61	----	----	37.38	----	----	----	37.99
0.78	33.77	52.64	120.35	0.61	----	----	37.01	----	----	----	37.62
0.80	32.56	52.63	120.27	0.61	----	----	36.55	----	----	----	37.16
0.82	31.36	52.62	120.19	0.61	----	----	36.02	----	----	----	36.63
0.83	30.15	52.61	120.10	0.61	----	----	35.42	----	----	----	36.03
0.85	28.95	52.60	119.99	0.61	----	----	34.75	----	----	----	35.36
0.87	27.74	52.59	119.88	0.60	----	----	34.07	----	----	----	34.67
0.88	26.53	52.57	119.75	0.60	----	----	33.33	----	----	----	33.94
0.90	25.33	52.56	119.62	0.60	----	----	32.55	----	----	----	33.15
0.92	24.12	52.54	119.48	0.60	----	----	31.73	----	----	----	32.33
0.93	22.92	52.53	119.34	0.60	----	----	30.87	----	----	----	31.47
0.95	21.71	52.51	119.19	0.59	----	----	29.98	----	----	----	30.57
0.97	20.50	52.49	119.03	0.59	----	----	29.08	----	----	----	29.67
0.98	19.30	52.48	118.87	0.59	----	----	28.18	----	----	----	28.76
1.00	18.09	52.46	118.70	0.59	----	----	27.25	----	----	----	27.83

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Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Outflow cfs
1.02	16.88	52.44	118.53	0.58	----	----	26.29	----	----	----	26.88
1.03	15.68	52.42	118.36	0.58	----	----	25.32	----	----	----	25.90
1.05	14.47	52.40	118.18	0.58	----	----	24.32	----	----	----	24.90
1.07	13.27	52.38	117.99	0.57	----	----	23.37	----	----	----	23.94
1.08	12.06	52.36	117.80	0.57	----	----	22.39	----	----	----	22.96
1.10	10.85	52.34	117.61	0.57	----	----	21.40	----	----	----	21.97
1.12	9.65	52.32	117.41	0.56	----	----	20.39	----	----	----	20.95
1.13	8.44	52.29	117.21	0.56	----	----	19.38	----	----	----	19.94
1.15	7.24	52.27	117.01	0.56	----	----	18.41	----	----	----	18.96
1.17	6.03	52.25	116.80	0.55	----	----	17.42	----	----	----	17.97
1.18	4.82	52.23	116.59	0.55	----	----	16.41	----	----	----	16.96
1.20	3.62	52.20	116.37	0.55	----	----	15.39	----	----	----	15.93
1.22	2.41	52.18	116.15	0.54	----	----	14.43	----	----	----	14.97
1.23	1.21	52.15	115.93	0.54	----	----	13.46	----	----	----	14.00
1.25	0.00	52.13	115.70	0.53	----	----	12.48	----	----	----	13.01
1.27	0.00	52.11	115.47	0.53	----	----	11.52	----	----	----	12.05
1.28	0.00	52.08	115.27	0.53	----	----	10.70	----	----	----	11.23
1.30	0.00	52.06	115.07	0.52	----	----	9.96	----	----	----	10.48
1.32	0.00	52.04	114.89	0.52	----	----	9.27	----	----	----	9.79
1.33	0.00	52.02	114.72	0.52	----	----	8.62	----	----	----	9.14
1.35	0.00	52.01	114.56	0.51	----	----	8.02	----	----	----	8.53
1.37	0.00	51.99	114.41	0.51	----	----	7.48	----	----	----	7.99
1.38	0.00	51.97	114.25	0.51	----	----	6.98	----	----	----	7.49
1.40	0.00	51.96	114.11	0.50	----	----	6.51	----	----	----	7.02
1.42	0.00	51.95	113.98	0.50	----	----	6.08	----	----	----	6.58
1.43	0.00	51.93	113.85	0.50	----	----	5.67	----	----	----	6.17
1.45	0.00	51.92	113.74	0.50	----	----	5.29	----	----	----	5.78
1.47	0.00	51.91	113.63	0.50	----	----	4.93	----	----	----	5.42
1.48	0.00	51.90	113.52	0.49	----	----	4.61	----	----	----	5.10
1.50	0.00	51.89	113.43	0.49	----	----	4.35	----	----	----	4.84
1.52	0.00	51.88	113.33	0.49	----	----	4.10	----	----	----	4.59
1.53	0.00	51.87	113.24	0.49	----	----	3.87	----	----	----	4.36
1.55	0.00	51.86	113.16	0.49	----	----	3.65	----	----	----	4.13
1.57	0.00	51.85	113.08	0.49	----	----	3.44	----	----	----	3.92

...End

Hydrograph Report

Page 1

English

Hyd. No. 22

10yr RAT post - routed

Hydrograph type = Reservoir
Storm frequency = 10 yrs
Inflow hyd. No. = 7
Max. Elevation = 53.01 ft

Peak discharge = 60.44 cfs
Time interval = 1 min
Reservoir name = existing basin
Max. Storage = 112,329 cuft

Storage Indication method used.

Total Volume = 177,633 cuft

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Outflow cfs
0.37	74.45	52.02	114.68	0.52	----	----	8.46	----	----	----	8.97
0.38	77.83	52.14	115.84	0.54	----	----	13.07	----	----	----	13.61
0.40	81.22	52.27	116.96	0.56	----	----	18.16	----	----	----	18.72
0.42	84.60 <<	52.38	118.04	0.57	----	----	23.60	----	----	----	24.17
0.43	82.91	52.49	119.02	0.59	----	----	29.04	----	----	----	29.63
0.45	81.22	52.59	119.88	0.60	----	----	34.13	----	----	----	34.73
0.47	79.53	52.67	120.63	0.62	----	----	38.77	----	----	----	39.39
0.48	77.83	52.74	121.26	0.63	----	----	42.91	----	----	----	43.54
0.50	76.14	52.80	121.80	0.64	----	----	46.51	----	----	----	47.15
0.52	74.45	52.86	122.25	0.64	----	----	49.65	----	----	----	50.30
0.53	72.76	52.90	122.62	0.65	----	----	52.26	----	----	----	52.91
0.55	71.07	52.93	122.92	0.65	----	----	54.46	----	----	----	55.11
0.57	69.37	52.96	123.15	0.66	----	----	56.21	----	----	----	56.87
0.58	67.68	52.98	123.34	0.66	----	----	57.56	----	----	----	58.22
0.60	65.99	53.00	123.47	0.66	----	----	58.56	----	----	----	59.22
0.62	64.30	53.01	123.56	0.66	----	----	59.23	----	----	----	59.89
0.63	62.60	53.01	123.61	0.66	----	----	59.62	----	----	----	60.28
0.65	60.91	53.01 <<	123.63	0.66	----	----	59.78	----	----	----	60.44 <<
0.67	59.22	53.01	123.63	0.66	----	----	59.74	----	----	----	60.40
0.68	57.53	53.01	123.60	0.66	----	----	59.51	----	----	----	60.18
0.70	55.84	53.00	123.55	0.66	----	----	59.13	----	----	----	59.79
0.72	54.14	53.00	123.48	0.66	----	----	58.59	----	----	----	59.25
0.73	52.45	52.99	123.38	0.66	----	----	57.90	----	----	----	58.56
0.75	50.76	52.97	123.28	0.66	----	----	57.09	----	----	----	57.75
0.77	49.07	52.96	123.15	0.66	----	----	56.19	----	----	----	56.84
0.78	47.38	52.94	123.02	0.65	----	----	55.19	----	----	----	55.84
0.80	45.68	52.93	122.87	0.65	----	----	54.11	----	----	----	54.76
0.82	43.99	52.91	122.71	0.65	----	----	52.95	----	----	----	53.60
0.83	42.30	52.89	122.55	0.65	----	----	51.77	----	----	----	52.41
0.85	40.61	52.87	122.37	0.64	----	----	50.54	----	----	----	51.19
0.87	38.92	52.85	122.19	0.64	----	----	49.27	----	----	----	49.91
0.88	37.22	52.83	122.00	0.64	----	----	47.94	----	----	----	48.58
0.90	35.53	52.81	121.81	0.64	----	----	46.58	----	----	----	47.22
0.92	33.84	52.78	121.61	0.63	----	----	45.22	----	----	----	45.86
0.93	32.15	52.76	121.40	0.63	----	----	43.84	----	----	----	44.47
0.95	30.46	52.74	121.19	0.63	----	----	42.43	----	----	----	43.06

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Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Outflow cfs
0.97	28.76	52.71	120.97	0.62	----	----	40.99	----	----	----	41.61
0.98	27.07	52.69	120.75	0.62	----	----	39.56	----	----	----	40.18
1.00	25.38	52.66	120.52	0.62	----	----	38.13	----	----	----	38.74
1.02	23.69	52.63	120.29	0.61	----	----	36.67	----	----	----	37.28
1.03	22.00	52.61	120.06	0.61	----	----	35.19	----	----	----	35.80
1.05	20.30	52.58	119.82	0.60	----	----	33.74	----	----	----	34.35
1.07	18.61	52.55	119.58	0.60	----	----	32.29	----	----	----	32.89
1.08	16.92	52.53	119.33	0.60	----	----	30.82	----	----	----	31.41
1.10	15.23	52.50	119.08	0.59	----	----	29.33	----	----	----	29.92
1.12	13.54	52.47	118.82	0.59	----	----	27.89	----	----	----	28.48
1.13	11.84	52.44	118.56	0.58	----	----	26.44	----	----	----	27.02
1.15	10.15	52.41	118.29	0.58	----	----	24.96	----	----	----	25.54
1.17	8.46	52.38	118.02	0.57	----	----	23.52	----	----	----	24.10
1.18	6.77	52.35	117.75	0.57	----	----	22.10	----	----	----	22.67
1.20	5.08	52.32	117.47	0.56	----	----	20.65	----	----	----	21.21
1.22	3.38	52.29	117.18	0.56	----	----	19.21	----	----	----	19.77
1.23	1.69	52.26	116.89	0.55	----	----	17.83	----	----	----	18.38
1.25	0.00	52.23	116.59	0.55	----	----	16.42	----	----	----	16.97
1.27	0.00	52.19	116.30	0.54	----	----	15.08	----	----	----	15.62
1.28	0.00	52.17	116.04	0.54	----	----	13.93	----	----	----	14.47
1.30	0.00	52.14	115.79	0.54	----	----	12.87	----	----	----	13.40
1.32	0.00	52.11	115.56	0.53	----	----	11.88	----	----	----	12.41
1.33	0.00	52.09	115.35	0.53	----	----	11.00	----	----	----	11.53
1.35	0.00	52.07	115.15	0.52	----	----	10.24	----	----	----	10.77
1.37	0.00	52.05	114.96	0.52	----	----	9.53	----	----	----	10.05
1.38	0.00	52.03	114.78	0.52	----	----	8.87	----	----	----	9.39
1.40	0.00	52.01	114.62	0.51	----	----	8.25	----	----	----	8.76
1.42	0.00	52.00	114.47	0.51	----	----	7.68	----	----	----	8.19
1.43	0.00	51.98	114.31	0.51	----	----	7.17	----	----	----	7.68
1.45	0.00	51.97	114.17	0.51	----	----	6.69	----	----	----	7.20
1.47	0.00	51.95	114.03	0.50	----	----	6.24	----	----	----	6.75
1.48	0.00	51.94	113.90	0.50	----	----	5.82	----	----	----	6.33

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Hydrograph Report

Page 1

English

Hyd. No. 23

25yr RAT post - routed

Hydrograph type = Reservoir
Storm frequency = 25 yrs
Inflow hyd. No. = 8
Max. Elevation = 53.18 ft

Peak discharge = 71.82 cfs
Time interval = 1 min
Reservoir name = existing basin
Max. Storage = 118,111 cuft

Storage Indication method used.

Total Volume = 206,923 cuft

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Outflow cfs
0.35	82.01	52.09	115.35	0.53	----	----	11.03	----	----	----	11.56
0.37	85.91	52.23	116.59	0.55	----	----	16.42	----	----	----	16.96
0.38	89.82	52.36	117.78	0.57	----	----	22.30	----	----	----	22.87
0.40	93.72	52.48	118.93	0.59	----	----	28.51	----	----	----	29.10
0.42	97.63 <<	52.60	120.02	0.61	----	----	34.96	----	----	----	35.57
0.43	95.67	52.72	121.01	0.62	----	----	41.26	----	----	----	41.88
0.45	93.72	52.81	121.86	0.64	----	----	46.95	----	----	----	47.59
0.47	91.77	52.89	122.58	0.65	----	----	51.99	----	----	----	52.64
0.48	89.82	52.96	123.18	0.66	----	----	56.41	----	----	----	57.06
0.50	87.86	53.02	123.67	0.66	----	----	60.02	----	----	----	60.69
0.52	85.91	53.06	124.04	0.67	----	----	62.89	----	----	----	63.56
0.53	83.96	53.10	124.34	0.67	----	----	65.23	----	----	----	65.91
0.55	82.01	53.12	124.58	0.68	----	----	67.16	----	----	----	67.84
0.57	80.05	53.15	124.77	0.68	----	----	68.65	----	----	----	69.33
0.58	78.10	53.16	124.91	0.68	----	----	69.75	----	----	----	70.44
0.60	76.15	53.17	125.00	0.68	----	----	70.51	----	----	----	71.19
0.62	74.20	53.18	125.06	0.69	----	----	70.96	----	----	----	71.65
0.63	72.24	53.18 <<	125.08	0.69	----	----	71.14	----	----	----	71.82 <<
0.65	70.29	53.18	125.07	0.69	----	----	71.08	----	----	----	71.76
0.67	68.34	53.18	125.04	0.69	----	----	70.80	----	----	----	71.48
0.68	66.39	53.17	124.98	0.68	----	----	70.33	----	----	----	71.02
0.70	64.43	53.16	124.90	0.68	----	----	69.70	----	----	----	70.38
0.72	62.48	53.15	124.80	0.68	----	----	68.91	----	----	----	69.60
0.73	60.53	53.14	124.69	0.68	----	----	68.00	----	----	----	68.68
0.75	58.58	53.12	124.56	0.68	----	----	66.97	----	----	----	67.64
0.77	56.62	53.11	124.42	0.68	----	----	65.83	----	----	----	66.50
0.78	54.67	53.09	124.26	0.67	----	----	64.63	----	----	----	65.30
0.80	52.72	53.07	124.10	0.67	----	----	63.36	----	----	----	64.03
0.82	50.77	53.05	123.92	0.67	----	----	62.01	----	----	----	62.68
0.83	48.81	53.03	123.74	0.67	----	----	60.60	----	----	----	61.26
0.85	46.86	53.00	123.55	0.66	----	----	59.13	----	----	----	59.79
0.87	44.91	52.98	123.33	0.66	----	----	57.53	----	----	----	58.19
0.88	42.96	52.95	123.11	0.66	----	----	55.88	----	----	----	56.53
0.90	41.00	52.93	122.88	0.65	----	----	54.19	----	----	----	54.84
0.92	39.05	52.90	122.65	0.65	----	----	52.47	----	----	----	53.12
0.93	37.10	52.87	122.41	0.64	----	----	50.79	----	----	----	51.43

Continues on next page...

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Outflow cfs
0.95	35.15	52.85	122.16	0.64	----	----	49.08	----	----	----	49.72
0.97	33.19	52.82	121.92	0.64	----	----	47.34	----	----	----	47.98
0.98	31.24	52.79	121.66	0.63	----	----	45.61	----	----	----	46.24
1.00	29.29	52.76	121.41	0.63	----	----	43.89	----	----	----	44.52
1.02	27.34	52.73	121.15	0.63	----	----	42.16	----	----	----	42.78
1.03	25.38	52.70	120.88	0.62	----	----	40.39	----	----	----	41.02
1.05	23.43	52.67	120.61	0.62	----	----	38.69	----	----	----	39.31
1.07	21.48	52.64	120.34	0.61	----	----	36.96	----	----	----	37.58
1.08	19.53	52.61	120.06	0.61	----	----	35.21	----	----	----	35.82
1.10	17.57	52.58	119.78	0.60	----	----	33.51	----	----	----	34.11
1.12	15.62	52.55	119.49	0.60	----	----	31.80	----	----	----	32.40
1.13	13.67	52.51	119.20	0.59	----	----	30.07	----	----	----	30.66
1.15	11.72	52.48	118.91	0.59	----	----	28.38	----	----	----	28.96
1.17	9.76	52.45	118.60	0.58	----	----	26.70	----	----	----	27.28
1.18	7.81	52.41	118.30	0.58	----	----	24.99	----	----	----	25.57
1.20	5.86	52.38	117.99	0.57	----	----	23.33	----	----	----	23.91
1.22	3.91	52.34	117.67	0.57	----	----	21.69	----	----	----	22.26
1.23	1.95	52.31	117.34	0.56	----	----	20.02	----	----	----	20.58
1.25	0.00	52.27	117.01	0.56	----	----	18.42	----	----	----	18.97
1.27	0.00	52.24	116.69	0.55	----	----	16.89	----	----	----	17.44
1.28	0.00	52.20	116.40	0.55	----	----	15.49	----	----	----	16.04
1.30	0.00	52.17	116.12	0.54	----	----	14.30	----	----	----	14.84
1.32	0.00	52.15	115.87	0.54	----	----	13.21	----	----	----	13.74
1.33	0.00	52.12	115.63	0.53	----	----	12.20	----	----	----	12.73
1.35	0.00	52.10	115.41	0.53	----	----	11.27	----	----	----	11.79
1.37	0.00	52.08	115.21	0.52	----	----	10.49	----	----	----	11.01
1.38	0.00	52.06	115.02	0.52	----	----	9.76	----	----	----	10.28
1.40	0.00	52.04	114.84	0.52	----	----	9.08	----	----	----	9.60
1.42	0.00	52.02	114.67	0.51	----	----	8.45	----	----	----	8.96
1.43	0.00	52.00	114.52	0.51	----	----	7.86	----	----	----	8.37
1.45	0.00	51.99	114.36	0.51	----	----	7.33	----	----	----	7.84
1.47	0.00	51.97	114.21	0.51	----	----	6.84	----	----	----	7.35

...End

Hydrograph Report

Page 1

English

Hyd. No. 24

100yr RAT post -routed

Hydrograph type = Reservoir
Storm frequency = 100 yrs
Inflow hyd. No. = 9
Max. Elevation = 53.44 ft

Peak discharge = 90.24 cfs
Time interval = 1 min
Reservoir name = existing basin
Max. Storage = 126,850 cuft

Storage Indication method used.

Total Volume = 253,326 cuft

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Outflow cfs
0.32	89.88	52.08	115.27	0.53	----	----	10.70	----	----	----	11.23
0.33	94.61	52.23	116.65	0.55	----	----	16.71	----	----	----	17.26
0.35	99.34	52.38	117.99	0.57	----	----	23.37	----	----	----	23.95
0.37	104.07	52.52	119.28	0.59	----	----	30.54	----	----	----	31.13
0.38	108.80	52.66	120.51	0.61	----	----	38.04	----	----	----	38.65
0.40	113.53	52.79	121.68	0.63	----	----	45.71	----	----	----	46.34
0.42	118.26 <<	52.92	122.79	0.65	----	----	53.49	----	----	----	54.14
0.43	115.89	53.03	123.75	0.67	----	----	60.68	----	----	----	61.35
0.45	113.53	53.12	124.51	0.68	----	----	66.56	----	----	----	67.24
0.47	111.16	53.19	125.15	0.69	----	----	71.67	----	----	----	72.36
0.48	108.80	53.25	125.68	0.69	----	----	76.04	----	----	----	76.73
0.50	106.43	53.30	126.11	0.70	----	----	79.64	----	----	----	80.35
0.52	104.07	53.34	126.45	0.71	----	----	82.63	----	----	----	83.34
0.53	101.70	53.38	126.72	0.71	----	----	84.98	----	----	----	85.69
0.55	99.34	53.40	126.93	0.71	----	----	86.76	----	----	----	87.47
0.57	96.97	53.42	127.08	0.72	----	----	88.08	----	----	----	88.79
0.58	94.61	53.43	127.17	0.72	----	----	88.94	----	----	----	89.66
0.60	92.24	53.43	127.23	0.72	----	----	89.40	----	----	----	90.12
0.62	89.88	53.44 <<	127.24	0.72	----	----	89.52	----	----	----	90.24 <<
0.63	87.51	53.43	127.22	0.72	----	----	89.33	----	----	----	90.05
0.65	85.15	53.43	127.17	0.72	----	----	88.87	----	----	----	89.59
0.67	82.78	53.42	127.09	0.72	----	----	88.18	----	----	----	88.89
0.68	80.42	53.41	126.99	0.71	----	----	87.28	----	----	----	87.99
0.70	78.05	53.39	126.87	0.71	----	----	86.21	----	----	----	86.93
0.72	75.69	53.38	126.73	0.71	----	----	85.01	----	----	----	85.72
0.73	73.32	53.36	126.57	0.71	----	----	83.66	----	----	----	84.37
0.75	70.96	53.34	126.40	0.71	----	----	82.19	----	----	----	82.90
0.77	68.59	53.32	126.22	0.70	----	----	80.62	----	----	----	81.32
0.78	66.22	53.29	126.03	0.70	----	----	78.96	----	----	----	79.66
0.80	63.86	53.27	125.82	0.70	----	----	77.26	----	----	----	77.95
0.82	61.49	53.24	125.61	0.69	----	----	75.47	----	----	----	76.17
0.83	59.13	53.22	125.39	0.69	----	----	73.62	----	----	----	74.31
0.85	56.76	53.19	125.16	0.69	----	----	71.73	----	----	----	72.42
0.87	54.40	53.16	124.92	0.68	----	----	69.83	----	----	----	70.51
0.88	52.03	53.13	124.67	0.68	----	----	67.87	----	----	----	68.55
0.90	49.67	53.11	124.42	0.68	----	----	65.87	----	----	----	66.54

Continues on next page...

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Outflow cfs
0.92	47.30	53.08	124.17	0.67	----	----	63.88	----	----	----	64.55
0.93	44.94	53.05	123.90	0.67	----	----	61.86	----	----	----	62.53
0.95	42.57	53.01	123.64	0.66	----	----	59.80	----	----	----	60.47
0.97	40.21	52.98	123.35	0.66	----	----	57.65	----	----	----	58.31
0.98	37.84	52.95	123.05	0.65	----	----	55.41	----	----	----	56.06
1.00	35.48	52.91	122.74	0.65	----	----	53.16	----	----	----	53.81
1.02	33.11	52.88	122.43	0.65	----	----	50.95	----	----	----	51.60
1.03	30.75	52.84	122.12	0.64	----	----	48.75	----	----	----	49.39
1.05	28.38	52.80	121.80	0.64	----	----	46.54	----	----	----	47.17
1.07	26.02	52.77	121.48	0.63	----	----	44.39	----	----	----	45.02
1.08	23.65	52.73	121.16	0.63	----	----	42.22	----	----	----	42.85
1.10	21.29	52.69	120.83	0.62	----	----	40.05	----	----	----	40.67
1.12	18.92	52.66	120.50	0.61	----	----	37.94	----	----	----	38.56
1.13	16.56	52.62	120.16	0.61	----	----	35.81	----	----	----	36.42
1.15	14.19	52.58	119.81	0.60	----	----	33.71	----	----	----	34.31
1.17	11.83	52.54	119.46	0.60	----	----	31.63	----	----	----	32.23
1.18	9.46	52.50	119.11	0.59	----	----	29.53	----	----	----	30.12
1.20	7.10	52.46	118.75	0.59	----	----	27.51	----	----	----	28.09
1.22	4.73	52.42	118.38	0.58	----	----	25.46	----	----	----	26.04
1.23	2.37	52.38	118.01	0.57	----	----	23.45	----	----	----	24.02
1.25	0.00	52.34	117.63	0.57	----	----	21.47	----	----	----	22.04
1.27	0.00	52.30	117.26	0.56	----	----	19.57	----	----	----	20.14
1.28	0.00	52.26	116.92	0.55	----	----	17.96	----	----	----	18.51
1.30	0.00	52.23	116.60	0.55	----	----	16.47	----	----	----	17.02
1.32	0.00	52.20	116.31	0.54	----	----	15.12	----	----	----	15.67
1.33	0.00	52.17	116.04	0.54	----	----	13.97	----	----	----	14.51
1.35	0.00	52.14	115.80	0.54	----	----	12.90	----	----	----	13.44
1.37	0.00	52.11	115.57	0.53	----	----	11.91	----	----	----	12.44
1.38	0.00	52.09	115.35	0.53	----	----	11.03	----	----	----	11.56
1.40	0.00	52.07	115.15	0.52	----	----	10.27	----	----	----	10.79
1.42	0.00	52.05	114.97	0.52	----	----	9.56	----	----	----	10.08
1.43	0.00	52.03	114.79	0.52	----	----	8.89	----	----	----	9.41

...End

Sediment Basin Calculations

Williamsburg Plantation: Section 5

Units 97-100 and 130-133 *Only*

4/11/01

James City County

For ~~Sec 5~~ - ex. Basin to be used for bldg above

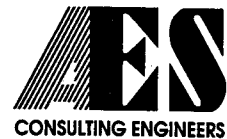
Add note from bottom of next page

2 Phases - Ph 1

Check on status of Permit -

Prepared by:
AES Consulting Engineers
5248 Olde Towne Rd.
Williamsburg, Va. 23188
(757) 253-0040

Submitted: April 11, 2001



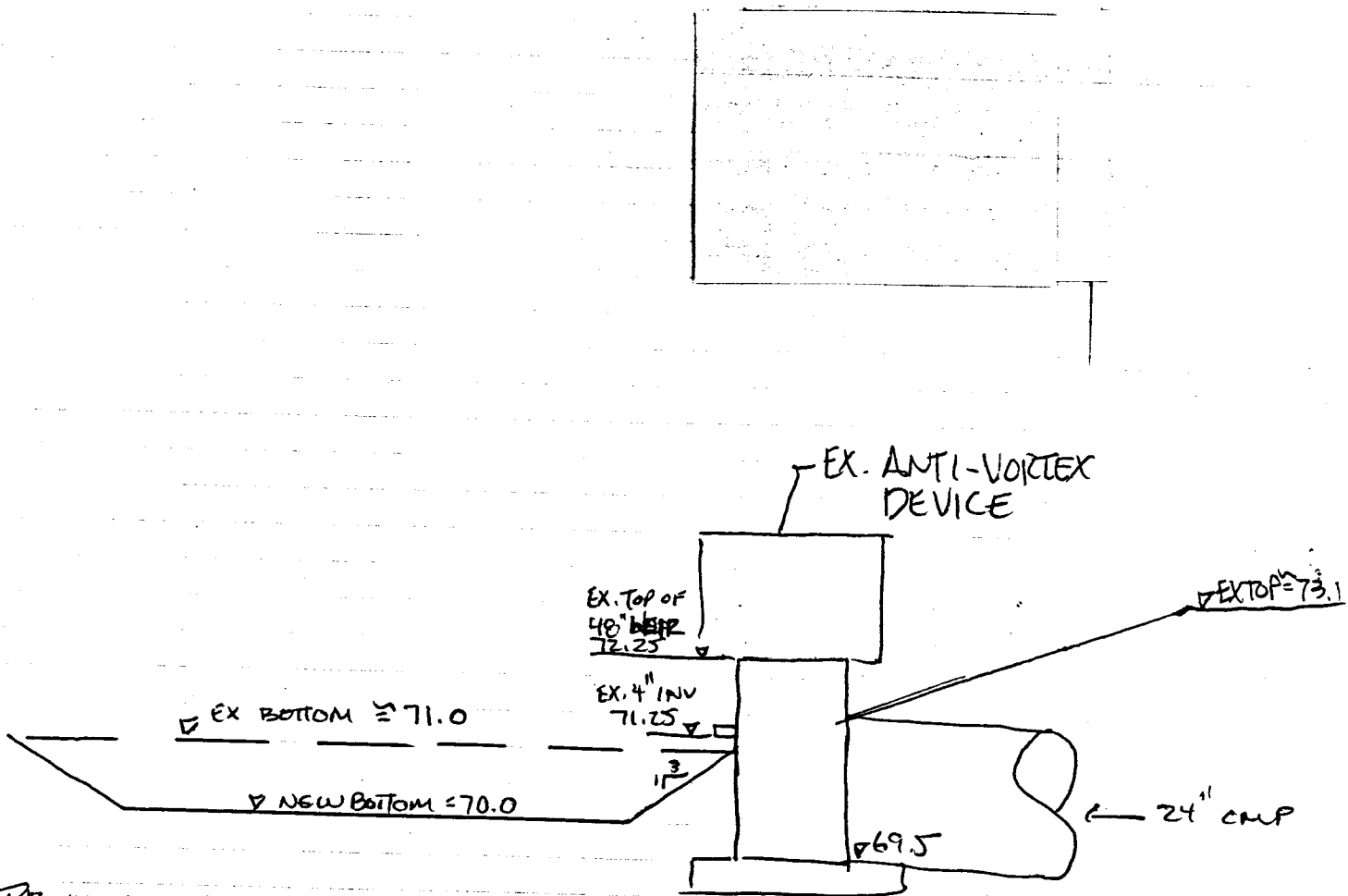
SEDIMENT TRAP DESIGN

DRAINAGE AREA = 7.6 AC; $C = 0.53$; $T_c = 20 \text{ min}$

DISTURBED DRAINAGE AREA = 2.18 AC [1.18 FROM ROAD EXT. PROJECT
+ 1.00 FROM THIS PROJECT]

REQ. WET VOLUME = $2.18 \text{ AC} \times 67 \text{ CY/AC} = 146 \text{ CY} \checkmark$

REQ. DRY VOLUME = $2.18 \text{ AC} \times 67 \text{ CY/AC} = 146 \text{ CY} \checkmark$



PROVIDED WET STORAGE = $255 \text{ CY} > 146 \text{ CY}$ [FROM ELEV 71.25 to 70.0] 175% OF REQUIRED

PROVIDED DRY STORAGE = $246 \text{ CY} > 146 \text{ CY}$ [FROM ELEV 72.25 to 71.25] 182% OF REQUIRED

SEE ROUTINGS \leftarrow

25 YR STORM ELEVATION = 72.81 \checkmark
 10 YR STORM ELEVATION = 72.74 \checkmark
 2 YR STORM ELEVATION = 72.6 \checkmark

ROUTINGS REPLICATE ENTIRE DRAINAGE AREA
 EXISTING TOP OF DAM SHALL BE RAISED TO ELEV = 73.8
 WITH EMERGENCY SPILLWAY @ 72.8' 4' WIDE (TOKEN)
 POND BOTTOM SHALL BE COVERED TO ELEVATION OF 70.0

Reservoir Report

Page 1

Reservoir No. 1 - Sediment Basin

English

Pond Data

Pond storage is based on known contour areas

Stage / Storage Table

Stage ft	Elevation ft	Contour area sqft	Incr. Storage cuft	Total storage cuft
0.00	70.00	3,996	0	0
1.00	71.00	6,350	5,173	5,173
2.00	72.00	7,314	6,832	12,005
3.00	73.00	9,212	8,263	20,268

Culvert / Orifice Structures

	[A]	[B]	[C]	[D]
Rise in	= 24.0	4.0	0.0	0.0
Span in	= 24.0	4.0	0.0	0.0
No. Barrels	= 1	1	0	0
Invert El. ft	= 69.50	71.25	0.00	0.00
Length ft	= 45.0	1.0	0.0	0.0
Slope %	= 4.11	0.00	0.00	0.00
N-Value	= .013	.013	.000	.000
Orif. Coeff.	= 0.60	0.60	0.00	0.00
Multi-Stage	= ---	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len ft	= 12.6	0.0	0.0	0.0
Crest El. ft	= 72.25	0.00	0.00	0.00
Weir Coeff.	= 3.00	3.00	0.00	0.00
Eqn. Exp.	= 1.50	1.50	0.00	0.00
Multi-Stage	= Yes	No	No	No

Tailwater Elevation = 68.00 ft

Stage / Storage / Discharge Table

Note: All outflows have been analyzed under inlet and outlet control.

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Discharge cfs
0.00	0	70.00	1.53	0.00	---	---	0.00	---	---	---	0.00
0.10	517	70.10	2.17	0.00	---	---	0.00	---	---	---	0.00
0.20	1,035	70.20	2.95	0.00	---	---	0.00	---	---	---	0.00
0.30	1,552	70.30	3.60	0.00	---	---	0.00	---	---	---	0.00
0.40	2,069	70.40	4.57	0.00	---	---	0.00	---	---	---	0.00
0.50	2,587	70.50	5.35	0.00	---	---	0.00	---	---	---	0.00
0.60	3,104	70.60	6.45	0.00	---	---	0.00	---	---	---	0.00
0.70	3,621	70.70	7.58	0.00	---	---	0.00	---	---	---	0.00
0.80	4,138	70.80	8.46	0.00	---	---	0.00	---	---	---	0.00
0.90	4,656	70.90	9.60	0.00	---	---	0.00	---	---	---	0.00
1.00	5,173	71.00	10.70	0.00	---	---	0.00	---	---	---	0.00

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Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Discharge cfs
1.10	5,856	71.10	11.73	0.00	---	---	0.00	---	---	---	0.00
1.20	6,539	71.20	12.68	0.00	---	---	0.00	---	---	---	0.00
1.30	7,223	71.30	13.65	0.01	---	---	0.00	---	---	---	0.01
1.40	7,906	71.40	14.50	0.05	---	---	0.00	---	---	---	0.05
1.50	8,589	71.50	15.13	0.12	---	---	0.00	---	---	---	0.12
1.60	9,272	71.60	15.86	0.18	---	---	0.00	---	---	---	0.18
1.70	9,955	71.70	16.57	0.19	---	---	0.00	---	---	---	0.19
1.80	10,639	71.80	17.24	0.26	---	---	0.00	---	---	---	0.26
1.90	11,322	71.90	17.90	0.29	---	---	0.00	---	---	---	0.29
2.00	12,005	72.00	18.52	0.32	---	---	0.00	---	---	---	0.32
2.10	12,831	72.10	19.13	0.35	---	---	0.00	---	---	---	0.35
2.20	13,658	72.20	19.72	0.37	---	---	0.00	---	---	---	0.37
2.30	14,484	72.30	20.29	0.39	---	---	0.42	---	---	---	0.82
2.40	15,310	72.40	20.85	0.42	---	---	2.19	---	---	---	2.61
2.50	16,136	72.50	21.39	0.44	---	---	4.71	---	---	---	5.15
2.60	16,963	72.60	21.92	0.46	---	---	7.80	---	---	---	8.26
2.70	17,789	72.70	22.43	0.48	---	---	11.37	---	---	---	11.85
2.80	18,615	72.80	22.94	0.49	---	---	15.37	---	---	---	15.86
2.90	19,442	72.90	23.43	0.48	---	---	19.75	---	---	---	20.22
3.00	20,268	73.00	23.91	0.35	---	---	24.47	---	---	---	23.91

...End

Hydrograph Summary Report

[illegible]

Hydrograph Report

Page 1

English

Hyd. No. 1

2 yr post-dev

Hydrograph type = Rational
Storm frequency = 2 yrs
Drainage area = 7.6 ac
Intensity = 3.26 in
I-D-F Curve = JCChydrographs.IDF

Peak discharge = 13.13 cfs
Time interval = 1 min
Runoff coeff. = 0.53
Time of conc. (Tc) = 20 min
Reced. limb factor = 1

Total Volume = 15,756 cuft

Hydrograph Discharge Table

Time -- Outflow (hrs cfs)	Time -- Outflow (hrs cfs)
0.03 1.31	0.57 3.94
0.05 1.97	0.58 3.28
0.07 2.63	0.60 2.63
0.08 3.28	0.62 1.97
0.10 3.94	0.63 1.31
0.12 4.60	
0.13 5.25	
0.15 5.91	...End
0.17 6.57	
0.18 7.22	
0.20 7.88	
0.22 8.53	
0.23 9.19	
0.25 9.85	
0.27 10.50	
0.28 11.16	
0.30 11.82	
0.32 12.47	
0.33 13.13 <<	
0.35 12.47	
0.37 11.82	
0.38 11.16	
0.40 10.50	
0.42 9.85	
0.43 9.19	
0.45 8.53	
0.47 7.88	
0.48 7.22	
0.50 6.57	
0.52 5.91	
0.53 5.25	
0.55 4.60	

Hydrograph Report

Page 1

English

Hyd. No. 2

10 yr post-dev

Hydrograph type = Rational
Storm frequency = 10 yrs
Drainage area = 7.6 ac
Intensity = 4.52 in
I-D-F Curve = JCChydrographs.IDF

Peak discharge = 18.21 cfs
Time interval = 1 min
Runoff coeff. = 0.53
Time of conc. (Tc) = 20 min
Reced. limb factor = 1

Total Volume = 21,857 cuft

Hydrograph Discharge Table

Time -- Outflow (hrs cfs)	Time -- Outflow (hrs cfs)
0.03 1.82	0.57 5.46
0.05 2.73	0.58 4.55
0.07 3.64	0.60 3.64
0.08 4.55	0.62 2.73
0.10 5.46	0.63 1.82
0.12 6.38	
0.13 7.29	
0.15 8.20	...End
0.17 9.11	
0.18 10.02	
0.20 10.93	
0.22 11.84	
0.23 12.75	
0.25 13.66	
0.27 14.57	
0.28 15.48	
0.30 16.39	
0.32 17.30	
0.33 18.21 <<	
0.35 17.30	
0.37 16.39	
0.38 15.48	
0.40 14.57	
0.42 13.66	
0.43 12.75	
0.45 11.84	
0.47 10.93	
0.48 10.02	
0.50 9.11	
0.52 8.20	
0.53 7.29	
0.55 6.38	

Hydrograph Report

Page 1

English

Hyd. No. 3

25 yr post-dev

Hydrograph type = Rational
Storm frequency = 25 yrs
Drainage area = 7.6 ac
Intensity = 5.19 in
I-D-F Curve = JCChydrographs.IDF

Peak discharge = 20.91 cfs
Time interval = 1 min
Runoff coeff. = 0.53
Time of conc. (Tc) = 20 min
Reced. limb factor = 1

Total Volume = 25,088 cuft

Hydrograph Discharge Table

Time -- Outflow (hrs cfs)	Time -- Outflow (hrs cfs)
0.03 2.09	0.57 6.27
0.05 3.14	0.58 5.23
0.07 4.18	0.60 4.18
0.08 5.23	0.62 3.14
0.10 6.27	0.63 2.09
0.12 7.32	
0.13 8.36	
0.15 9.41	...End
0.17 10.45	
0.18 11.50	
0.20 12.54	
0.22 13.59	
0.23 14.63	
0.25 15.68	
0.27 16.73	
0.28 17.77	
0.30 18.82	
0.32 19.86	
0.33 20.91 <<	
0.35 19.86	
0.37 18.82	
0.38 17.77	
0.40 16.73	
0.42 15.68	
0.43 14.63	
0.45 13.59	
0.47 12.54	
0.48 11.50	
0.50 10.45	
0.52 9.41	
0.53 8.36	
0.55 7.32	

Hydrograph Report

Page 1

English

Hyd. No. 5

2-yr Routed

Hydrograph type = Reservoir
Storm frequency = 2 yrs
Inflow hyd. No. = 1
Max. Elevation = 72.58 ft

Peak discharge = 7.70 cfs
Time interval = 1 min
Reservoir name = Sediment Basin
Max. Storage = 16,816 cuft

Storage Indication method used.

Total Volume = 15,209 cuft

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Outflow cfs
0.35	12.47	72.35	20.59	0.41	----	----	1.38	----	----	----	1.79
0.37	11.82	72.42	20.98	0.42	----	----	2.80	----	----	----	3.23
0.38	11.16	72.48	21.28	0.43	----	----	4.19	----	----	----	4.62
0.40	10.50	72.52	21.50	0.44	----	----	5.34	----	----	----	5.78
0.42	9.85	72.55	21.65	0.45	----	----	6.22	----	----	----	6.67
0.43	9.19	72.57	21.75	0.45	----	----	6.80	----	----	----	7.25
0.45	8.53	72.58	21.80	0.45	----	----	7.12	----	----	----	7.58
0.47	7.88	72.58 <<	21.82	0.45	----	----	7.25	----	----	----	7.70 <<
0.48	7.22	72.58	21.82	0.45	----	----	7.22	----	----	----	7.67
0.50	6.57	72.58	21.79	0.45	----	----	7.06	----	----	----	7.51
0.52	5.91	72.57	21.75	0.45	----	----	6.80	----	----	----	7.26
0.53	5.25	72.56	21.69	0.45	----	----	6.47	----	----	----	6.92
0.55	4.60	72.54	21.62	0.45	----	----	6.07	----	----	----	6.51
0.57	3.94	72.53	21.54	0.44	----	----	5.61	----	----	----	6.06
0.58	3.28	72.51	21.46	0.44	----	----	5.12	----	----	----	5.56
0.60	2.63	72.50	21.37	0.44	----	----	4.61	----	----	----	5.05
0.62	1.97	72.48	21.27	0.43	----	----	4.15	----	----	----	4.58
0.63	1.31	72.46	21.16	0.43	----	----	3.66	----	----	----	4.09
0.65	0.66	72.44	21.05	0.42	----	----	3.14	----	----	----	3.56
0.67	0.00	72.42	20.94	0.42	----	----	2.60	----	----	----	3.02
0.68	0.00	72.40	20.83	0.42	----	----	2.12	----	----	----	2.53
0.70	0.00	72.38	20.73	0.41	----	----	1.81	----	----	----	2.23
0.72	0.00	72.36	20.65	0.41	----	----	1.55	----	----	----	1.95
0.73	0.00	72.35	20.57	0.41	----	----	1.31	----	----	----	1.72
0.75	0.00	72.34	20.51	0.40	----	----	1.10	----	----	----	1.51
0.77	0.00	72.33	20.45	0.40	----	----	0.92	----	----	----	1.32
0.78	0.00	72.32	20.40	0.40	----	----	0.76	----	----	----	1.16
0.80	0.00	72.31	20.36	0.40	----	----	0.62	----	----	----	1.02
0.82	0.00	72.30	20.32	0.40	----	----	0.50	----	----	----	0.89
0.83	0.00	72.30	20.28	0.39	----	----	0.41	----	----	----	0.81
0.85	0.00	72.29	20.25	0.39	----	----	0.39	----	----	----	0.78

...End

Hydrograph Report

Page 1

English

Hyd. No. 6

10-yr. routed

Hydrograph type = Reservoir
Storm frequency = 10 yrs
Inflow hyd. No. = 2
Max. Elevation = 72.74 ft

Peak discharge = 13.28 cfs
Time interval = 1 min
Reservoir name = Sediment Basin
Max. Storage = 18,083 cuft

Storage Indication method used.

Total Volume = 21,310 cuft

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Outflow cfs
0.30	16.39	72.38	20.74	0.41	----	----	1.84	----	----	----	2.26
0.32	17.30	72.48	21.27	0.43	----	----	4.15	----	----	----	4.59
0.33	18.21 <<	72.56	21.73	0.45	----	----	6.70	----	----	----	7.15
0.35	17.30	72.63	22.09	0.46	----	----	8.98	----	----	----	9.45
0.37	16.39	72.68	22.33	0.47	----	----	10.68	----	----	----	11.15
0.38	15.48	72.71	22.49	0.48	----	----	11.82	----	----	----	12.30
0.40	14.57	72.73	22.58	0.48	----	----	12.51	----	----	----	12.99
0.42	13.66	72.74 <<	22.61	0.48	----	----	12.80	----	----	----	13.28 <<
0.43	12.75	72.74	22.61	0.48	----	----	12.78	----	----	----	13.26
0.45	11.84	72.73	22.58	0.48	----	----	12.53	----	----	----	13.01
0.47	10.93	72.72	22.53	0.48	----	----	12.12	----	----	----	12.60
0.48	10.02	72.71	22.46	0.48	----	----	11.58	----	----	----	12.06
0.50	9.11	72.69	22.38	0.47	----	----	10.99	----	----	----	11.46
0.52	8.20	72.67	22.29	0.47	----	----	10.34	----	----	----	10.82
0.53	7.29	72.65	22.18	0.47	----	----	9.64	----	----	----	10.11
0.55	6.38	72.63	22.07	0.46	----	----	8.89	----	----	----	9.35
0.57	5.46	72.61	21.96	0.46	----	----	8.10	----	----	----	8.56
0.58	4.55	72.59	21.84	0.45	----	----	7.35	----	----	----	7.80
0.60	3.64	72.56	21.71	0.45	----	----	6.60	----	----	----	7.05
0.62	2.73	72.54	21.58	0.44	----	----	5.82	----	----	----	6.27
0.63	1.82	72.51	21.44	0.44	----	----	5.02	----	----	----	5.46
0.65	0.91	72.48	21.30	0.43	----	----	4.28	----	----	----	4.71
0.67	0.00	72.45	21.14	0.43	----	----	3.57	----	----	----	3.99
0.68	0.00	72.43	21.00	0.42	----	----	2.90	----	----	----	3.32
0.70	0.00	72.41	20.88	0.42	----	----	2.34	----	----	----	2.76
0.72	0.00	72.39	20.78	0.41	----	----	1.97	----	----	----	2.38
0.73	0.00	72.37	20.69	0.41	----	----	1.68	----	----	----	2.09
0.75	0.00	72.36	20.61	0.41	----	----	1.43	----	----	----	1.83
0.77	0.00	72.34	20.54	0.40	----	----	1.21	----	----	----	1.61
0.78	0.00	72.33	20.48	0.40	----	----	1.01	----	----	----	1.41

...End

Hydrograph Report

Page 1

English

Hyd. No. 7

25-yr routed

Hydrograph type = Reservoir
Storm frequency = 25 yrs
Inflow hyd. No. = 3
Max. Elevation = 72.81 ft

Peak discharge = 16.15 cfs
Time interval = 1 min
Reservoir name = Sediment Basin
Max. Storage = 18,670 cuft

Storage Indication method used.

Total Volume = 24,541 cuft

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Outflow cfs
0.28	17.77	72.40	20.87	0.42	---	---	2.30	---	---	---	2.72
0.30	18.82	72.51	21.43	0.44	---	---	4.96	---	---	---	5.39
0.32	19.86	72.60	21.91	0.46	---	---	7.77	---	---	---	8.23
0.33	20.91 <<	72.68	22.32	0.47	---	---	10.55	---	---	---	11.03
0.35	19.86	72.74	22.62	0.48	---	---	12.84	---	---	---	13.32
0.37	18.82	72.77	22.81	0.49	---	---	14.36	---	---	---	14.85
0.38	17.77	72.80	22.92	0.49	---	---	15.23	---	---	---	15.73
0.40	16.73	72.81	22.97	0.49	---	---	15.64	---	---	---	16.13
0.42	15.68	72.81 <<	22.97	0.49	---	---	15.66	---	---	---	16.15 <<
0.43	14.63	72.80	22.94	0.49	---	---	15.39	---	---	---	15.88
0.45	13.59	72.79	22.88	0.49	---	---	14.94	---	---	---	15.43
0.47	12.54	72.77	22.81	0.49	---	---	14.34	---	---	---	14.83
0.48	11.50	72.76	22.72	0.49	---	---	13.63	---	---	---	14.11
0.50	10.45	72.74	22.62	0.48	---	---	12.83	---	---	---	13.32
0.52	9.41	72.72	22.51	0.48	---	---	11.98	---	---	---	12.46
0.53	8.36	72.69	22.39	0.47	---	---	11.10	---	---	---	11.58
0.55	7.32	72.67	22.27	0.47	---	---	10.24	---	---	---	10.71
0.57	6.27	72.64	22.14	0.47	---	---	9.34	---	---	---	9.81
0.58	5.23	72.62	22.01	0.46	---	---	8.41	---	---	---	8.87
0.60	4.18	72.59	21.87	0.46	---	---	7.50	---	---	---	7.95
0.62	3.14	72.56	21.72	0.45	---	---	6.63	---	---	---	7.08
0.63	2.09	72.53	21.56	0.44	---	---	5.73	---	---	---	6.17
0.65	1.05	72.50	21.41	0.44	---	---	4.80	---	---	---	5.24
0.67	0.00	72.47	21.24	0.43	---	---	4.00	---	---	---	4.43
0.68	0.00	72.44	21.08	0.43	---	---	3.25	---	---	---	3.68
0.70	0.00	72.42	20.94	0.42	---	---	2.64	---	---	---	3.06
0.72	0.00	72.40	20.83	0.42	---	---	2.14	---	---	---	2.56
0.73	0.00	72.38	20.74	0.41	---	---	1.83	---	---	---	2.25
0.75	0.00	72.36	20.65	0.41	---	---	1.56	---	---	---	1.97
0.77	0.00	72.35	20.58	0.41	---	---	1.33	---	---	---	1.73

...End

AES CONSULTING ENGINEERS

Engineering, Surveying and Planning

5248 Olde Towne Road, Suite 1

WILLIAMSBURG, VIRGINIA 23188

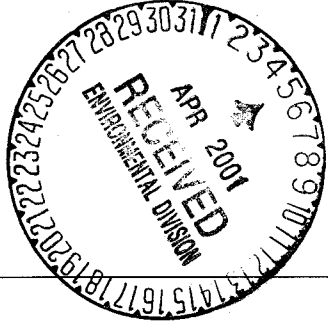
LETTER OF TRANSMITTAL(757) 253-0040
FAX (757) 220-8994TO JCC ENVIRONMENTAL DIVISION

DATE 4/5/01	JOB NO. 7555-12B
ATTENTION MR. DARRYL COOK	
RE: WILLIAMSBURG TOWNATION SECTION 5 UNITS 97-100 & 130-133	

WE ARE SENDING YOU ☒ Attached ☐ Under separate cover via _____ the following items:

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REMARKS

DARRYL,
PLEASE CALL UPON RECEIPT TO DISCUSS THE
SEDIMENT BASIN CONFIGURATION FOR THE PROJECT.
PER KAREN DRAKE, WE WILL BE MEETING TO
DISCUSS THIS PROJECT FURTHER ON WEDNESDAY
APRIL 11TH @ 2:00 PM.

SIGNED: CHARLES RECORDS

COPY TO _____

If enclosures are not as noted, kindly notify us at once.

Drainage Calculations

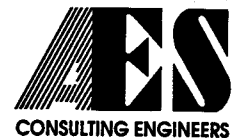
Williamsburg Plantation: Section 5

Units 97-100 and 130-133 *Only*

James City County

**Prepared by:
AES Consulting Engineers
5248 Olde Towne Rd.
Williamsburg, Va. 23188
(757) 253-0040**

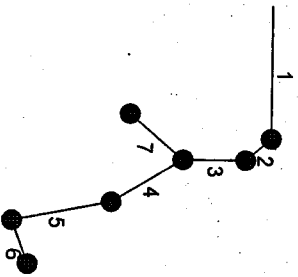
Submitted: April 2, 2001



Hydraflow Plan View

EXISTING SYSTEM

AVENUE CORNER HOUSE
LINE



Project file: 755514sys1-32101.stm

IDF file: JCCstormsewer.IDF

No. Lines: 7

04-04-2001

Hydraulic Storm Sewer Rehabilitation

Station	Line	To Line	Len (ft)	Drng Area		Rnoft coeff (C)	Area x C		Tc		Rain (l) (in/hr)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
				Incr (ac)	Total (ac)		Incr	Total	Inlet (min)	Syst (min)					Size (in)	Slope (%)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	
✓ 1	End		179.0	0.18	2.46	0.90	0.16	1.64	5.0	11.9	5.6	9.24	15.54	5.85	18	2.19	74.78	70.86	75.94	72.25	79.79	72.36	4D-3D
✓ 2	1		38.0	0.51	2.28	0.75	0.38	1.48	5.0	11.7	5.7	8.38	6.95	6.83	15	1.16	75.22	74.78	77.04	76.40	79.98	79.79	4E-4D
✓ 3	2		60.0	0.32	1.77	0.70	0.22	1.10	5.0	11.4	5.7	6.28	7.36	5.12	15	1.30	76.00	75.22	78.16	77.59	82.84	79.98	4F-4E
✓ 4	3		90.0	0.27	0.99	0.60	0.16	0.53	5.0	10.9	5.8	3.08	17.35	3.42	15	7.22	82.50	76.00	83.20	78.46	86.50	82.84	4G-4F
✓ 5	4		100.0	0.18	0.72	0.40	0.07	0.37	5.0	10.3	5.9	2.18	6.46	3.16	15	1.00	83.50	82.50	84.09	83.33	87.50	86.50	4H-4G
✓ 6	5		60.0	0.54	0.54	0.55	0.30	0.30	10.0	10.0	6.0	1.77	4.57	2.62	15	0.50	83.80	83.50	84.38	84.32	87.50	87.50	4I-4H
✓ 7	3		80.0	0.46	0.46	0.75	0.34	0.34	5.0	5.0	7.1	2.46	10.21	2.99	15	2.50	78.00	76.00	78.63	78.46	81.67	82.84	4F1-4F

Project File: 755514sys1-32101.stm

I-D-F File: JCCStormsewer.IDF

Total number of lines: 7

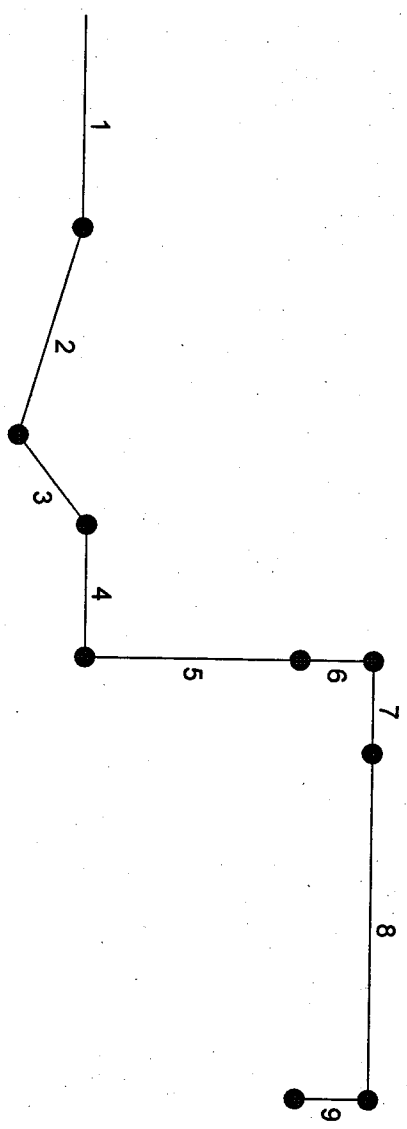
Run Date: 04-04-2001

NOTES: Intensity = 143.72 / (Tc + 19.20) ^ 0.94; Return period = 10 Yrs.; Initial tailwater elevation = 72.25 (ft)

Hydratlow Plan View

PROPOSED SYSTEM.

INCLUDING
CONCRETE BASE ROAD EXTENSION
IMPROVEMENT



Project file: 755512bsys1.stm	IDF file: JCCstormsewer.IDF	No. Lines: 9	04-04-2001
-------------------------------	-----------------------------	--------------	------------

Hydraflow Storm Sewer Tabulation

Station	Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (l)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	
1 End	136.0	0.35	2.25	0.75	0.26	1.49	5.0	14.1	5.3	7.85	27.43	3.77	24	1.47	72.00	70.00	72.99	72.25	80.40	72.00	6 - Outfall
2 1	138.0	0.31	1.90	0.55	0.17	1.23	10.0	13.3	5.4	6.61	43.05	4.10	24	3.62	77.00	72.00	77.91	73.17	80.00	80.40	7-6
3 2	70.0	0.06	1.59	0.65	0.04	1.06	5.0	13.0	5.5	5.76	38.23	3.77	24	2.86	79.00	77.00	79.85	78.17	83.50	80.00	10-7
4 3	85.0	0.00	1.53	0.00	0.00	1.02	0.0	12.5	5.5	5.62	25.73	3.85	24	1.29	80.10	79.00	80.94	80.09	87.00	83.50	11-10
5 4	124.0	0.18	1.53	0.90	0.16	1.02	5.0	11.8	5.6	5.74	23.16	3.79	24	1.05	81.40	80.10	82.25	81.25	88.92	87.00	12-11
6 5	42.0	0.09	1.35	0.60	0.05	0.86	5.0	11.6	5.7	4.86	24.68	3.92	24	1.19	81.90	81.40	82.68	82.30	88.92	88.92	13-12
7 6	59.0	0.35	1.26	0.61	0.21	0.80	10.0	11.2	5.7	4.60	22.81	3.45	24	1.02	82.50	81.90	83.26	82.97	90.16	88.92	14-13
8 7	222.0	0.68	0.91	0.56	0.38	0.59	10.0	10.0	6.0	3.51	8.99	4.40	15	1.94	86.80	82.50	87.55	83.30	94.14	90.16	15-14
9 8	42.0	0.23	0.23	0.90	0.21	0.21	5.0	5.0	7.1	1.47	15.75	2.33	15	5.95	89.30	86.80	89.79	87.87	94.14	94.14	16-15

Project File: 756512bsys1.stm

I-D-F File: JCCstormsewer.IDF

Total number of lines: 9

Run Date: 04-04-2001

NOTES: Intensity = 143.72 / (Tc + 19.20) ^ 0.94; Return period = 10 Yrs.; Initial tailwater elevation = 72.25 (ft)

Drainage Calculations

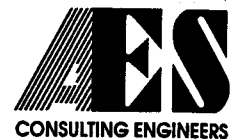
Williamsburg Plantation: Section 5

Units 97-100 and 130-133 *Only*

James City County

Prepared by:
AES Consulting Engineers
5248 Olde Towne Rd.
Williamsburg, Va. 23188
(757) 253-0040

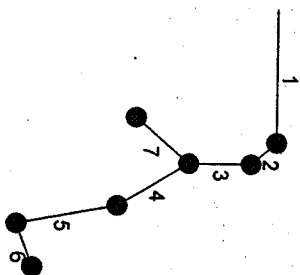
Submitted: April 2, 2001



Hydraflow Plan View

EXISTING SYSTEM

ALONG CONCH HOUSE
LANE



Project file: 755514sys1-32101.stm

IDF file: JCCstormsewer.IDF

No. Lines: 7

04-04-2001

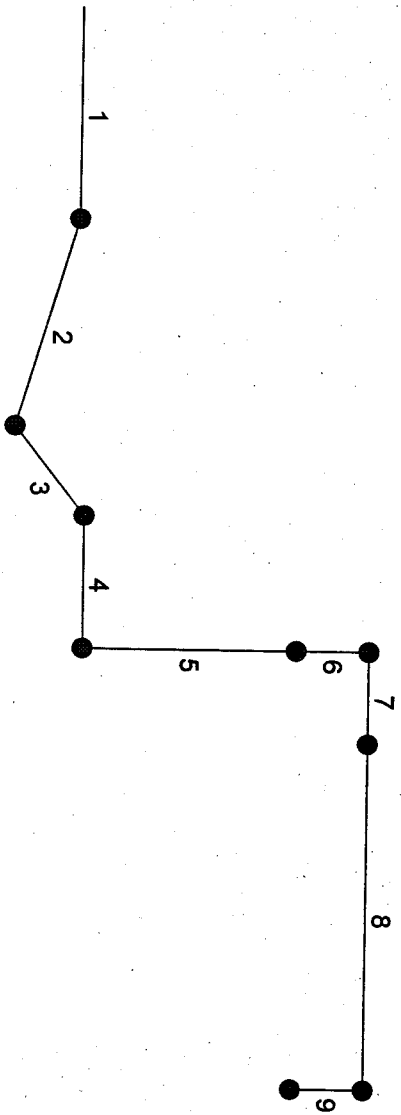
Station	Line	To Line	Len (ft)	Drng Area		Rnoff coeff	Area x C		Tc		Rain (l)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
				Incr (ac)	Total (ac)		Incr	Total	Inlet (min)	Syst (min)					Size (in)	Slope (%)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	
1	End		179.0	0.18	2.46	0.90	0.16	1.64	5.0	11.9	5.6	9.24	15.54	5.85	18	2.19	74.78	70.86	75.94	72.25	79.79	72.36	4D-3D
2	1		38.0	0.51	2.28	0.75	0.38	1.48	5.0	11.7	5.7	8.38	6.95	6.83	15	1.16	75.22	74.78	77.04	76.40	79.98	79.79	4E-4D
3	2		60.0	0.32	1.77	0.70	0.22	1.10	5.0	11.4	5.7	6.28	7.36	5.12	15	1.30	76.00	75.22	78.16	77.59	82.84	79.98	4F-4E
4	3		90.0	0.27	0.99	0.60	0.16	0.53	5.0	10.9	5.8	3.08	17.35	3.42	15	7.22	82.50	76.00	83.20	78.46	86.50	82.84	4G-4F
5	4		100.0	0.18	0.72	0.40	0.07	0.37	5.0	10.3	5.9	2.18	6.46	3.16	15	1.00	83.50	82.50	84.09	83.33	87.50	86.50	4H-4G
6	5		60.0	0.54	0.54	0.55	0.30	0.30	10.0	10.0	6.0	1.77	4.57	2.62	15	0.50	83.80	83.50	84.38	84.32	87.50	87.50	4I-4H
7	3		80.0	0.46	0.46	0.75	0.34	0.34	5.0	5.0	7.1	2.46	10.21	2.99	15	2.50	78.00	76.00	78.63	78.46	81.67	82.84	4F1-4F
Project File: 755514sys1-32101.stm			I-D-F File: JCCStormsewer.IDF										Total number of lines: 7						Run Date: 04-04-2001				

NOTES: Intensity = 143.72 / (Tc + 19.20) ^ 0.94; Return period = 10 Yrs.; Initial tailwater elevation = 72.25 (ft)

Hydrant Plan View

PROPOSED SYSTEM.

INCLUDING
CONCRETE HOSE ROAD EXTENSION
IMPROVEMENT



Project file: 755512bsys1.stm

IDF file: JCCstormsewer.IDF

No. Lines: 9

04-04-2001

Hydraflow Storm Sewer Tabulation

Station	Line	To Line	Len (ft)	Drng Area		Rnoff coeff (C)	Area x C		Tc		Rain (l)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
				Incr (ac)	Total (ac)		Incr	Total	Inlet (min)	Syst (min)					Size (in)	Slope (%)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	
1	End		136.0	0.35	2.25	0.75	0.26	1.49	5.0	14.1	5.3	7.85	27.43	3.77	24	1.47	72.00	70.00	72.99	72.25	80.40	72.00	6 - Outfall
2	1		138.0	0.31	1.90	0.55	0.17	1.23	10.0	13.3	5.4	6.61	43.05	4.10	24	3.62	77.00	72.00	77.91	73.17	80.00	80.40	7-6
3	2		70.0	0.06	1.59	0.65	0.04	1.06	5.0	13.0	5.5	5.76	38.23	3.77	24	2.86	79.00	77.00	79.85	78.17	83.50	80.00	10-7
4	3		85.0	0.00	1.53	0.00	0.00	1.02	0.0	12.5	5.5	5.62	25.73	3.85	24	1.29	80.10	79.00	80.94	80.09	87.00	83.50	11-10
5	4		124.0	0.18	1.53	0.90	0.16	1.02	5.0	11.8	5.6	5.74	23.16	3.79	24	1.05	81.40	80.10	82.25	81.25	88.92	87.00	12-11
6	5		42.0	0.09	1.35	0.60	0.05	0.86	5.0	11.6	5.7	4.86	24.68	3.92	24	1.19	81.90	81.40	82.68	82.30	88.92	88.92	13-12
7	6		59.0	0.35	1.26	0.61	0.21	0.80	10.0	11.2	5.7	4.60	22.81	3.45	24	1.02	82.50	81.90	83.26	82.97	90.16	88.92	14-13
8	7		222.0	0.68	0.91	0.56	0.38	0.59	10.0	10.0	6.0	3.51	8.99	4.40	15	1.94	86.80	82.50	87.55	83.30	94.14	90.16	15-14
9	8		42.0	0.23	0.23	0.90	0.21	0.21	5.0	5.0	7.1	1.47	15.75	2.33	15	5.95	89.30	86.80	89.79	87.87	94.14	94.14	16-15

Project File: 755512bsys1.stm

I-D-F File: JCCstormsewer.IDF

Total number of lines: 9

Run Date: 04-04-2001

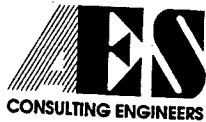
NOTES: Intensity = 143.72 / (Tc + 19.20) ^ 0.94; Return period = 10 Yrs.; Initial tailwater elevation = 72.25 (ft)

STORMWATER MANAGEMENT/ BMP CALCULATIONS
FOR

COMBINED FACILITY
FOR
WILLIAMSBURG PLANTATION
AND
VDOT 199 – FACILITY “G”

Prepared By:
AES Consulting Engineers
5248 Olde Towne Road, Suite 1
Williamsburg, Virginia 23188
Submitted: February 26, 1999
Revised: March 21, 2001

Supporting Data



5248 Olde Towne Road, Suite 1
Williamsburg, Virginia 23188
(757) 253-0040
Fax: (757) 220-8994

PROJECT _____
PROJECT NO. _____
SUBJECT _____
SHEET NO. _____ OF _____
CALCULATED BY _____ DATE _____

DRAINAGE AREA SERVED BY POND

W.P. AREA = 19.06 AC

TOTAL VDOT AREA = 27.30 AC

DOUBLE COUNTING OF W.P. DRAINAGE AREA HAS OCCURRED
AREA *

1	0.90 AC	← 0.35 AC @ C=0.35 + 0.55 AC @ C=0.90
2	4.56 AC	4.56 AC @ C=0.35
3	1.37 AC	1.37 AC @ C=0.35
<u>Σ = 6.83 AC</u>		

TOTAL REVISED DRAINAGE AREA = 19.06 + 27.30 - 6.83
= 39.53 AC

DETERMINE % IMPERVIOUS

WP = 7.68 AC

VDOT = 5.21 AC

+ 0.84 AC

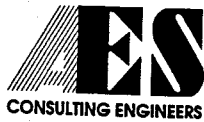
- 0.55 AC

5.50 AC

← FROM "EXHIBIT E" OF NMM (50% IMPERVIOUS OF 1.68 AC UNACCOUNTED)
DESIGN GROUP TESTED SPH
← FROM ABOVE DOUBLE COUNT

TOTAL = 13.18 AC

% IMP = $\frac{13.18}{39.53} (100) = \underline{\underline{32.7\%}}$ ←



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PROJECT _____
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CALCULATED BY _____ DATE _____

PRE-DEVELOPMENT

WP. AREA = 19.06 AC

WOODED / GRASSED \rightarrow CN = 73 ; C = 0.35

VDOT AREA = 27.30 AC

AVG. GRASS \rightarrow CN = 71 ; C = 0.35

$$CN = \frac{19.06(73) + (27.30 - 6.83) 71}{39.53} = 71.96 \approx 72 \quad \text{PRE DEV}$$

$\rightarrow C = 0.35 \leftarrow$

POST-DEVELOPMENT

WP AREA

IMPERV. AREA

OPEN

AC

7.68

CN = 98

C = 0.9

11.38

CN = 74

C = 0.35

E = 19.06

CN = 84

C = 0.57

VDOT AREA

IMPERV. AREA

5.50

CN = 98

C = 0.9

OPEN

21.25

CN = 74

C = 0.35

-6.28

CN = 74

C = 0.35

E = 20.47

CN = 80

C = 0.50

OVERALL

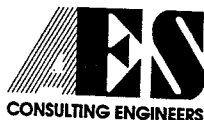
39.53

CN = 82

C = 0.53

PRE-DEV. 39.53 AC ; CN = 72 ; C = 0.35

POST-DEV 39.53 AC ; CN = 82 ; C = 0.53



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DETERMINE RQD WATER QUALITY VOLUME

DESIGN TYPE 4. DETAIN 1" FOR 24 HRS

$$RQD V = 1" (13.18 AC) \frac{1'}{12"} (43560 SF/AC)$$

$$= 47,843 CF = OBTAINED @ ELEV = 48.57 \quad 48.66$$

$$PROVIDED V @ ELEV = 49.33 \text{ IS } \frac{68,415}{11,913} CF > 47,843 CF$$

REVISED DUE TO
AVOID VDOT
WETLAND
IMPACTS AND
ROW 3:1.55

DETERMINE ORIFICE FOR 24 HOUR RELEASE

$$ORIFICE ELEV = 47.0$$

TRY TO USE 4" (EXISTING ORIFICE)

$$A = \pi r^2$$

$$= \pi \left(\frac{2}{2}\right)^2$$

$$= 0.0872 SF$$

$$Q_r = C A \sqrt{2gh}$$

$$= 0.6 (0.0872) \sqrt{2(32.2) \cdot 0.83}$$

$$0.383$$

$$= 0.372 CFS$$

$$C = 0.6$$

$$A = 0.0872 SF$$

$$g = 32.2 \text{ ft/s}^2$$

$$h = \frac{48.66 - 47.0}{2} = 0.83$$

$$Q_r = \frac{49,840 CF}{(X) SEC}$$

$$X = \frac{49,840}{0.372 \cdot 0.383}$$

$$= \frac{133,978 S}{130,295} = 37.2 HR$$

SIZE NEW WATER QUALITY ORIFICE FOR 24 HR DETENTION

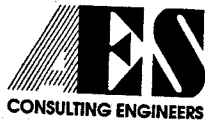
$$Q_r = \frac{47,843 CF}{86,400 S} = 0.554 CFS$$

$$Q_r = 0.6 (A) \sqrt{2(32.2) \cdot 0.83}$$

$$A = \frac{0.1263}{0.1299} SF$$

$$r = \frac{0.200}{0.203} = 2.41"$$

$$d = \frac{4.88}{4.82} \leftarrow \text{USE } 4" \therefore \text{EXISTING ORIFICE IS OK.}$$



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DETERMINE MODIFICATIONS NEEDED TO FUNCTION AS
SEDIMENT BASIN:

$$WP \text{ AREA} = 19.06 \text{ AC}$$

$$REQ. \text{ DRY VOLUME} = 19.06 \text{ AC} (67 \text{ CY/AC}) = 34,480 \text{ CF}$$

$$@ \text{ELEV} = 48.2 \quad \text{PROV. VOLUME} = \frac{33967}{36,807} \text{ CF} < \text{PROVIDED } 98.5\% \text{ CF}$$

$$@ \text{ELEV} = 49.33 \quad \text{PROV. VOLUME} = \frac{48415}{42941 - 36,807} = \frac{33967}{36,734} \text{ CF}$$

$$REQ. \text{ WET VOLUME} = 34,480 \text{ CF} \approx \frac{34448}{36,734} \text{ CF} \therefore \text{OK}$$

SIZE ORIFICE @ ELEV = 48.2 FOR 6HR DRAWDOWN
OF WET VOLUME:

$$Q_R = \frac{36,734 \text{ CF}}{21,600 \text{ S}} = 1.70 \text{ CFS}$$

$$Q_R = C A \sqrt{2gh}$$

$$C = 0.6$$

$$g = 32.2 \text{ ft/s}^2$$

$$1.70 \text{ CFS} = 0.6 A \sqrt{2(32.2) 0.57}$$

$$\Delta h = \frac{49.33 - 48.2}{2} = 0.57'$$

$$A = 0.468 \text{ SF} = \pi r^2$$

$$r = 0.39' = 4.63''$$

$$d = 9.26'' \leftarrow \text{USE } 8'' \text{ ORIFICE}$$

IF 4" (EX. ORIFICE) WAS USED WHAT IS DRAWDOWN TIME:

$$Q_R = 0.6 (0.0872 \text{ SF}) \sqrt{2(32.2) 0.57}$$

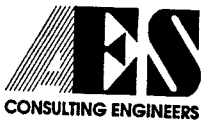
$$A = \pi \left(\frac{2}{12}\right)^2 = 0.0872 \text{ SF}$$

$$= 0.317 \text{ CFS}$$

$$Q_R = \frac{36,734 \text{ CF}}{(X) \text{ SEC.}}$$

$$X = \frac{36,734 \text{ CF}}{0.317 \text{ CFS}}$$

$$= 115,883 \text{ S} = \underline{\underline{32.2 \text{ HR}}}$$



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SHEET NO. _____ OF _____
CALCULATED BY _____ DATE _____

ANTI-SEEP COLLARS

$$L_s = Y(Z + 4) \left(1 + \frac{S}{0.25 - S} \right) \leftarrow \text{FROM VESCH}$$
$$= (49.33 - 47.0) [3 + 4] \left(1 + \frac{0.0042}{0.25 - (0.0042)} \right)$$
$$= 16.6' \approx 17' \leftarrow 10\% \text{ INCREASE IN SEEPAGE LENGTH}$$

FROM PLATE 3.14-12 \rightarrow USE 1 COLLAR (5.2' x 5.2')
OF VESCH
OR
2 COLLARS (4.2' x 4.2')

USE 1 5.2' x 5.2' ANTI-SEEP COLLAR 24' FROM
THE DOWNSTREAM END OF OUTLET BARREL

EMERGENCY SPILLWAY DESIGN

PER VDOT, MR. JOHN DEMELL, EMERGENCY SPILLWAY SHOULD
BE 20' WIDE AND LOCATED AT ELEVATION 524.0

$$Q_{100} \text{ THROUGH SPILLWAY} = 51.1 \text{ CFS}$$

$$S_L = 0.167 \text{ FT/FT}$$

$$n = 0.0395 (d_{50})^{1/6}; \text{ CLASS I } d_{50} \leq 1.1' \text{ PER VESCH}$$
$$= 0.04$$

$$Q_n = 0.04 (51.1)$$

$$= 2.04$$

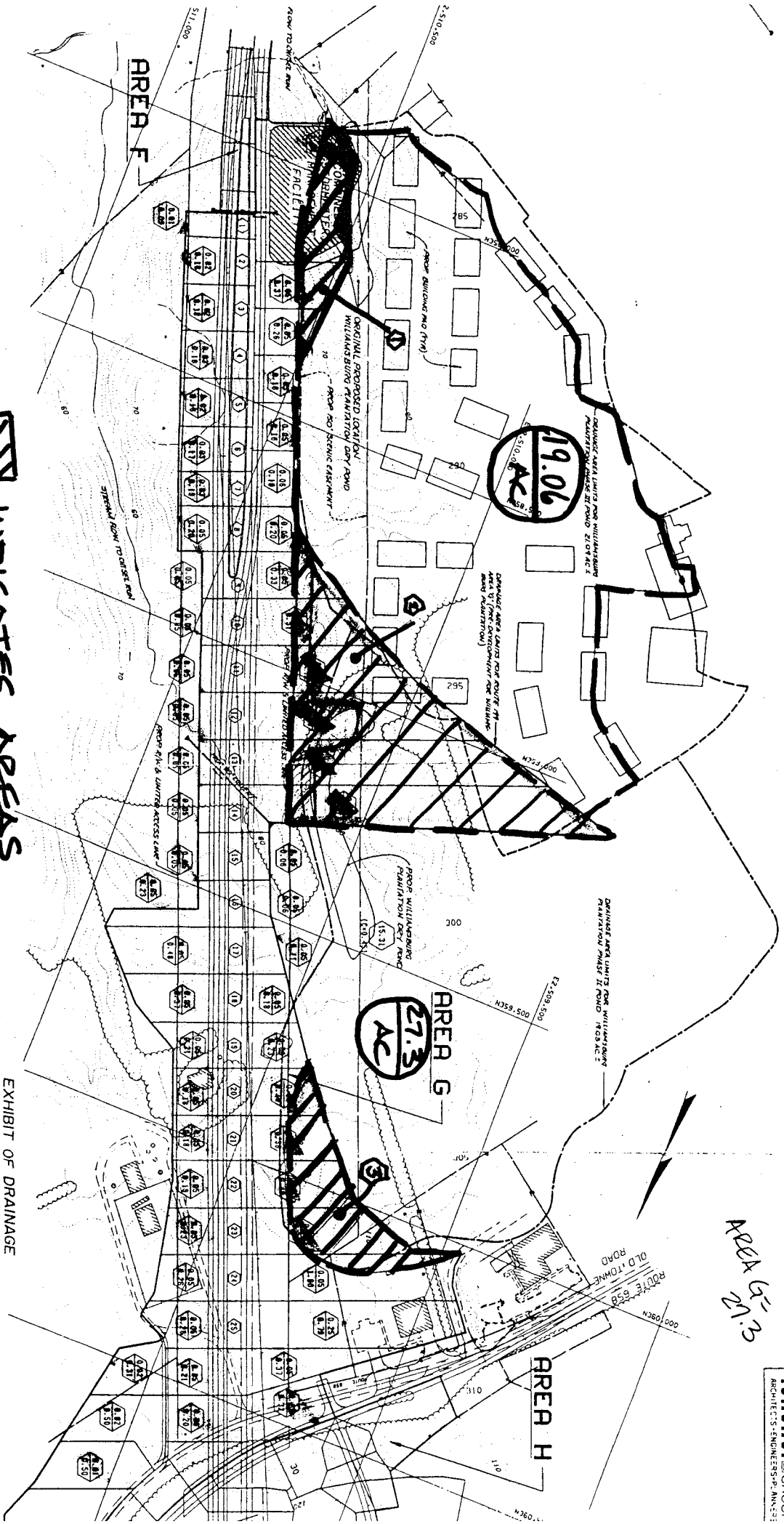
$$d \approx 0.5'; V = 9.75 \text{ FPS}$$

SIZE SEDIMENT FOREBAY

$$\text{REQUIRED VOLUME} = 10\% \text{ WQV}$$
$$= 0.1 (47,873 \text{ CF})$$
$$= 4,787 \text{ CF}$$

$$\text{PROVIDED VOLUME} = 4,888 > 4,787$$

Area G-21.3



INDICATES "AREAS
PREVIOUSLY DOUBLE
COUNTED" AND WILLIAMSBURG PLANTATION

EXHIBIT OF DRAINAGE
AREAS FOR ROUTE 199
WILLIAMSBURG PLANTATION

"THE EXISTING CONTOURS SHOWN
HEREIN WERE SUPPLIED BY VDOT.
ADDITIONAL LINES EXTENDING BEYOND
THESE CONTOURS WERE ESTABLISHED
USING THE BEST AVAILABLE RECORD
INFORMATION."

INDEX

① 0.06	① 0.11	⑦ 0.03
② 0.02	② 0.06	⑧ 0.05
③ 0.05	③ 0.11	⑨ 0.05
④ 0.11	④ 0.07	⑩ 0.10
⑤ 0.05	⑤ 0.11	⑪ 0.05
⑥ 0.05	⑥ 0.11	⑫ 0.05

LEGEND

① 0.05	DRAINAGE AREA 19.05
② 1.23	DRAINAGE AREA 19.05

ROUTE 199
EXHIBIT "E"
SHEET 1 OF 1
N.T.S.

Rational Method Hydrographs

Hydrograph Report

Page 1

English

Hyd. No. 35

2-yr pre

Hydrograph type = Rational
Storm frequency = 2 yrs
Drainage area = 39.5 ac
Intensity = 2.48 in
I-D-F Curve = JCChydrographs.IDF

Peak discharge = 34.28 cfs
Time interval = 1 min
Runoff coeff. = 0.35
Time of conc. (Tc) = 32 min
Reced. limb factor = 2

Total Volume = 98,741 cuft

Hydrograph Discharge Table

Time -- Outflow (hrs cfs)	Time -- Outflow (hrs cfs)	Time -- Outflow (hrs cfs)
0.07 4.29	0.60 32.14	1.13 15.00
0.08 5.36	0.62 31.61	1.15 14.46
0.10 6.43	0.63 31.07	1.17 13.93
0.12 7.50	0.65 30.54	1.18 13.39
0.13 8.57	0.67 30.00	1.20 12.86
0.15 9.64	0.68 29.46	1.22 12.32
0.17 10.71	0.70 28.93	1.23 11.79
0.18 11.79	0.72 28.39	1.25 11.25
0.20 12.86	0.73 27.86	1.27 10.71
0.22 13.93	0.75 27.32	1.28 10.18
0.23 15.00	0.77 26.79	1.30 9.64
0.25 16.07	0.78 26.25	1.32 9.11
0.27 17.14	0.80 25.71	1.33 8.57
0.28 18.21	0.82 25.18	1.35 8.04
0.30 19.29	0.83 24.64	1.37 7.50
0.32 20.36	0.85 24.11	1.38 6.96
0.33 21.43	0.87 23.57	1.40 6.43
0.35 22.50	0.88 23.04	1.42 5.89
0.37 23.57	0.90 22.50	1.43 5.36
0.38 24.64	0.92 21.96	1.45 4.82
0.40 25.71	0.93 21.43	1.47 4.29
0.42 26.79	0.95 20.89	1.48 3.75
0.43 27.86	0.97 20.36	
0.45 28.93	0.98 19.82	
0.47 30.00	1.00 19.29	...End
0.48 31.07	1.02 18.75	
0.50 32.14	1.03 18.21	
0.52 33.21	1.05 17.68	
0.53 34.28 <<	1.07 17.14	
0.55 33.75	1.08 16.61	
0.57 33.21	1.10 16.07	
0.58 32.68	1.12 15.54	

Hydrograph Report

Page 1

English

Hyd. No. 36

10-yr pre

Hydrograph type = Rational
Storm frequency = 10 yrs
Drainage area = 39.5 ac
Intensity = 3.52 in
I-D-F Curve = JCChydrographs.IDF

Peak discharge = 48.64 cfs
Time interval = 1 min
Runoff coeff. = 0.35
Time of conc. (Tc) = 32 min
Reced. limb factor = 2

Total Volume = 140,076 cuft

Hydrograph Discharge Table

Time -- Outflow (hrs cfs)	Time -- Outflow (hrs cfs)	Time -- Outflow (hrs cfs)
0.07 6.08	0.60 45.60	1.13 21.28
0.08 7.60	0.62 44.84	1.15 20.52
0.10 9.12	0.63 44.08	1.17 19.76
0.12 10.64	0.65 43.32	1.18 19.00
0.13 12.16	0.67 42.56	1.20 18.24
0.15 13.68	0.68 41.80	1.22 17.48
0.17 15.20	0.70 41.04	1.23 16.72
0.18 16.72	0.72 40.28	1.25 15.96
0.20 18.24	0.73 39.52	1.27 15.20
0.22 19.76	0.75 38.76	1.28 14.44
0.23 21.28	0.77 38.00	1.30 13.68
0.25 22.80	0.78 37.24	1.32 12.92
0.27 24.32	0.80 36.48	1.33 12.16
0.28 25.84	0.82 35.72	1.35 11.40
0.30 27.36	0.83 34.96	1.37 10.64
0.32 28.88	0.85 34.20	1.38 9.88
0.33 30.40	0.87 33.44	1.40 9.12
0.35 31.92	0.88 32.68	1.42 8.36
0.37 33.44	0.90 31.92	1.43 7.60
0.38 34.96	0.92 31.16	1.45 6.84
0.40 36.48	0.93 30.40	1.47 6.08
0.42 38.00	0.95 29.64	1.48 5.32
0.43 39.52	0.97 28.88	
0.45 41.04	0.98 28.12	
0.47 42.56	1.00 27.36	...End
0.48 44.08	1.02 26.60	
0.50 45.60	1.03 25.84	
0.52 47.12	1.05 25.08	
0.53 48.64 <<	1.07 24.32	
0.55 47.88	1.08 23.56	
0.57 47.12	1.10 22.80	
0.58 46.36	1.12 22.04	

Hydrograph Report

Page 1

English

Hyd. No. 37

25-yr pre

Hydrograph type = Rational
Storm frequency = 25 yrs
Drainage area = 39.5 ac
Intensity = 4.08 in
I-D-F Curve = JCChydrographs.IDF

Peak discharge = 56.45 cfs
Time interval = 1 min
Runoff coeff. = 0.35
Time of conc. (Tc) = 32 min
Reced. limb factor = 2

Total Volume = 162,577 cuft

Hydrograph Discharge Table

Time -- Outflow (hrs cfs)	Time -- Outflow (hrs cfs)	Time -- Outflow (hrs cfs)
0.07 7.06	0.60 52.92	1.13 24.70
0.08 8.82	0.62 52.04	1.15 23.81
0.10 10.58	0.63 51.16	1.17 22.93
0.12 12.35	0.65 50.28	1.18 22.05
0.13 14.11	0.67 49.39	1.20 21.17
0.15 15.88	0.68 48.51	1.22 20.29
0.17 17.64	0.70 47.63	1.23 19.40
0.18 19.40	0.72 46.75	1.25 18.52
0.20 21.17	0.73 45.87	1.27 17.64
0.22 22.93	0.75 44.98	1.28 16.76
0.23 24.70	0.77 44.10	1.30 15.88
0.25 26.46	0.78 43.22	1.32 14.99
0.27 28.23	0.80 42.34	1.33 14.11
0.28 29.99	0.82 41.46	1.35 13.23
0.30 31.75	0.83 40.57	1.37 12.35
0.32 33.52	0.85 39.69	1.38 11.47
0.33 35.28	0.87 38.81	1.40 10.58
0.35 37.05	0.88 37.93	1.42 9.70
0.37 38.81	0.90 37.05	1.43 8.82
0.38 40.57	0.92 36.16	1.45 7.94
0.40 42.34	0.93 35.28	1.47 7.06
0.42 44.10	0.95 34.40	1.48 6.17
0.43 45.87	0.97 33.52	
0.45 47.63	0.98 32.64	
0.47 49.39	1.00 31.75	...End
0.48 51.16	1.02 30.87	
0.50 52.92	1.03 29.99	
0.52 54.69	1.05 29.11	
0.53 56.45 <<	1.07 28.23	
0.55 55.57	1.08 27.34	
0.57 54.69	1.10 26.46	
0.58 53.80	1.12 25.58	

Hydrograph Report

Page 1

English

Hyd. No. 38

100-yr pre

Hydrograph type = Rational
Storm frequency = 100 yrs
Drainage area = 39.5 ac
Intensity = 4.98 in
I-D-F Curve = JCChydrographs.IDF

Peak discharge = 68.84 cfs
Time interval = 1 min
Runoff coeff. = 0.35
Time of conc. (Tc) = 32 min
Reced. limb factor = 2

Total Volume = 198,266 cuft

Hydrograph Discharge Table

Time -- Outflow (hrs cfs)	Time -- Outflow (hrs cfs)	Time -- Outflow (hrs cfs)
0.07 8.61	0.60 64.54	1.13 30.12
0.08 10.76	0.62 63.46	1.15 29.04
0.10 12.91	0.63 62.39	1.17 27.97
0.12 15.06	0.65 61.31	1.18 26.89
0.13 17.21	0.67 60.24	1.20 25.82
0.15 19.36	0.68 59.16	1.22 24.74
0.17 21.51	0.70 58.09	1.23 23.66
0.18 23.66	0.72 57.01	1.25 22.59
0.20 25.82	0.73 55.93	1.27 21.51
0.22 27.97	0.75 54.86	1.28 20.44
0.23 30.12	0.77 53.78	1.30 19.36
0.25 32.27	0.78 52.71	1.32 18.29
0.27 34.42	0.80 51.63	1.33 17.21
0.28 36.57	0.82 50.56	1.35 16.13
0.30 38.72	0.83 49.48	1.37 15.06
0.32 40.88	0.85 48.40	1.38 13.98
0.33 43.03	0.87 47.33	1.40 12.91
0.35 45.18	0.88 46.25	1.42 11.83
0.37 47.33	0.90 45.18	1.43 10.76
0.38 49.48	0.92 44.10	1.45 9.68
0.40 51.63	0.93 43.03	1.47 8.61
0.42 53.78	0.95 41.95	1.48 7.53
0.43 55.93	0.97 40.88	
0.45 58.09	0.98 39.80	
0.47 60.24	1.00 38.72	...End
0.48 62.39	1.02 37.65	
0.50 64.54	1.03 36.57	
0.52 66.69	1.05 35.50	
0.53 68.84 <<	1.07 34.42	
0.55 67.77	1.08 33.35	
0.57 66.69	1.10 32.27	
0.58 65.62	1.12 31.19	

Hydrograph Report

Page 1

English

Hyd. No. 10

2 yr storm

Hydrograph type = Rational
Storm frequency = 2 yrs
Drainage area = 39.5 ac
Intensity = 2.88 in
I-D-F Curve = JCChydrographs.IDF

Peak discharge = 60.30 cfs
Time interval = 1 min
Runoff coeff. = 0.53
Time of conc. (Tc) = 25 min
Reced. limb factor = 2

Total Volume = 135,682 cuft

Hydrograph Discharge Table

Time -- Outflow (hrs cfs)	Time -- Outflow (hrs cfs)	Time -- Outflow (hrs cfs)
0.05 7.24	0.58 48.24	1.12 9.65
0.07 9.65	0.60 47.04	1.13 8.44
0.08 12.06	0.62 45.83	1.15 7.24
0.10 14.47	0.63 44.62	1.17 6.03
0.12 16.88	0.65 43.42	
0.13 19.30	0.67 42.21	
0.15 21.71	0.68 41.01	...End
0.17 24.12	0.70 39.80	
0.18 26.53	0.72 38.59	
0.20 28.95	0.73 37.39	
0.22 31.36	0.75 36.18	
0.23 33.77	0.77 34.98	
0.25 36.18	0.78 33.77	
0.27 38.59	0.80 32.56	
0.28 41.01	0.82 31.36	
0.30 43.42	0.83 30.15	
0.32 45.83	0.85 28.95	
0.33 48.24	0.87 27.74	
0.35 50.65	0.88 26.53	
0.37 53.07	0.90 25.33	
0.38 55.48	0.92 24.12	
0.40 57.89	0.93 22.92	
0.42 60.30 <<	0.95 21.71	
0.43 59.10	0.97 20.50	
0.45 57.89	0.98 19.30	
0.47 56.69	1.00 18.09	
0.48 55.48	1.02 16.88	
0.50 54.27	1.03 15.68	
0.52 53.07	1.05 14.47	
0.53 51.86	1.07 13.27	
0.55 50.65	1.08 12.06	
0.57 49.45	1.10 10.85	

Hydrograph Report

Page 1

English

Hyd. No. 11

10 yr storm

Hydrograph type = Rational
Storm frequency = 10 yrs
Drainage area = 39.5 ac
Intensity = 4.04 in
I-D-F Curve = JCChydrographs.IDF

Peak discharge = 84.60 cfs
Time interval = 1 min
Runoff coeff. = 0.53
Time of conc. (Tc) = 25 min
Reced. limb factor = 2

Total Volume = 190,353 cuft

Hydrograph Discharge Table

Time -- Outflow (hrs cfs)	Time -- Outflow (hrs cfs)	Time -- Outflow (hrs cfs)
0.05 10.15	0.58 67.68	1.12 13.54
0.07 13.54	0.60 65.99	1.13 11.84
0.08 16.92	0.62 64.30	1.15 10.15
0.10 20.30	0.63 62.60	1.17 8.46
0.12 23.69	0.65 60.91	
0.13 27.07	0.67 59.22	
0.15 30.46	0.68 57.53	...End
0.17 33.84	0.70 55.84	
0.18 37.22	0.72 54.14	
0.20 40.61	0.73 52.45	
0.22 43.99	0.75 50.76	
0.23 47.38	0.77 49.07	
0.25 50.76	0.78 47.38	
0.27 54.14	0.80 45.68	
0.28 57.53	0.82 43.99	
0.30 60.91	0.83 42.30	
0.32 64.30	0.85 40.61	
0.33 67.68	0.87 38.92	
0.35 71.07	0.88 37.22	
0.37 74.45	0.90 35.53	
0.38 77.83	0.92 33.84	
0.40 81.22	0.93 32.15	
0.42 84.60 <<	0.95 30.46	
0.43 82.91	0.97 28.76	
0.45 81.22	0.98 27.07	
0.47 79.53	1.00 25.38	
0.48 77.83	1.02 23.69	
0.50 76.14	1.03 22.00	
0.52 74.45	1.05 20.30	
0.53 72.76	1.07 18.61	
0.55 71.07	1.08 16.92	
0.57 69.37	1.10 15.23	

Hydrograph Report

Page 1

English

Hyd. No. 12

25 yr storm

Hydrograph type = Rational
Storm frequency = 25 yrs
Drainage area = 39.5 ac
Intensity = 4.66 in
I-D-F Curve = JCChydrographs.IDF

Peak discharge = 97.63 cfs
Time interval = 1 min
Runoff coeff. = 0.53
Time of conc. (Tc) = 25 min
Reced. limb factor = 2

Total Volume = 219,658 cuft

Hydrograph Discharge Table

Time -- Outflow (hrs cfs)	Time -- Outflow (hrs cfs)	Time -- Outflow (hrs cfs)
0.05 11.72	0.58 78.10	1.12 15.62
0.07 15.62	0.60 76.15	1.13 13.67
0.08 19.53	0.62 74.20	1.15 11.72
0.10 23.43	0.63 72.24	1.17 9.76
0.12 27.34	0.65 70.29	
0.13 31.24	0.67 68.34	
0.15 35.15	0.68 66.39	...End
0.17 39.05	0.70 64.43	
0.18 42.96	0.72 62.48	
0.20 46.86	0.73 60.53	
0.22 50.77	0.75 58.58	
0.23 54.67	0.77 56.62	
0.25 58.58	0.78 54.67	
0.27 62.48	0.80 52.72	
0.28 66.39	0.82 50.77	
0.30 70.29	0.83 48.81	
0.32 74.20	0.85 46.86	
0.33 78.10	0.87 44.91	
0.35 82.01	0.88 42.96	
0.37 85.91	0.90 41.00	
0.38 89.82	0.92 39.05	
0.40 93.72	0.93 37.10	
0.42 97.63 <<	0.95 35.15	
0.43 95.67	0.97 33.19	
0.45 93.72	0.98 31.24	
0.47 91.77	1.00 29.29	
0.48 89.82	1.02 27.34	
0.50 87.86	1.03 25.38	
0.52 85.91	1.05 23.43	
0.53 83.96	1.07 21.48	
0.55 82.01	1.08 19.53	
0.57 80.05	1.10 17.57	

Hydrograph Report

Page 1

English

Hyd. No. 13

100 yr storm

Hydrograph type = Rational
Storm frequency = 100 yrs
Drainage area = 39.5 ac
Intensity = 5.64 in
I-D-F Curve = JCChydrographs.IDF

Peak discharge = 118.26 cfs
Time interval = 1 min
Runoff coeff. = 0.53
Time of conc. (Tc) = 25 min
Reced. limb factor = 2

Total Volume = 266,082 cuft

Hydrograph Discharge Table

Time -- Outflow (hrs cfs)	Time -- Outflow (hrs cfs)	Time -- Outflow (hrs cfs)
0.05 14.19	0.58 94.61	1.12 18.92
0.07 18.92	0.60 92.24	1.13 16.56
0.08 23.65	0.62 89.88	1.15 14.19
0.10 28.38	0.63 87.51	1.17 11.83
0.12 33.11	0.65 85.15	
0.13 37.84	0.67 82.78	
0.15 42.57	0.68 80.42	...End
0.17 47.30	0.70 78.05	
0.18 52.03	0.72 75.69	
0.20 56.76	0.73 73.32	
0.22 61.49	0.75 70.96	
0.23 66.22	0.77 68.59	
0.25 70.96	0.78 66.22	
0.27 75.69	0.80 63.86	
0.28 80.42	0.82 61.49	
0.30 85.15	0.83 59.13	
0.32 89.88	0.85 56.76	
0.33 94.61	0.87 54.40	
0.35 99.34	0.88 52.03	
0.37 104.07	0.90 49.67	
0.38 108.80	0.92 47.30	
0.40 113.53	0.93 44.94	
0.42 118.26 <<	0.95 42.57	
0.43 115.89	0.97 40.21	
0.45 113.53	0.98 37.84	
0.47 111.16	1.00 35.48	
0.48 108.80	1.02 33.11	
0.50 106.43	1.03 30.75	
0.52 104.07	1.05 28.38	
0.53 101.70	1.07 26.02	
0.55 99.34	1.08 23.65	
0.57 96.97	1.10 21.29	

SCS Method Hydrographs

Hydrograph Report

Page 1

English

Hyd. No. 1

2 YEAR PRE-DEV

Hydrograph type = SCS Runoff
Storm frequency = 2 yrs
Drainage area = 39.53 ac
Basin Slope = 3.7 %
Tc method = LAG
Total precip. = 3.50 in
Storm duration = 24 hrs

Peak discharge = 31.50 cfs
Time interval = 12 min
Curve number = 72
Hydraulic length = 1670 ft
Time of conc. (Tc) = 31.7 min
Distribution = Type II
Shape factor = 484

Total Volume = 150,792 cuft

Hydrograph Discharge Table

Time -- Outflow (hrs cfs)

11.80	4.84
12.00	19.92
12.20	31.50 <<
12.40	24.89
12.60	16.01
12.80	7.57
13.00	6.01
13.20	5.04
13.40	4.45
13.60	4.01
13.80	3.64
14.00	3.32

...End

Hydrograph Report

Page 1

English

Hyd. No. 2

10 YEAR PRE-DEV

Hydrograph type = SCS Runoff
Storm frequency = 10 yrs
Drainage area = 39.53 ac
Basin Slope = 3.7 %
Tc method = LAG
Total precip. = 5.80 in
Storm duration = 24 hrs

Peak discharge = 84.89 cfs
Time interval = 12 min
Curve number = 72
Hydraulic length = 1670 ft
Time of conc. (Tc) = 31.7 min
Distribution = Type II
Shape factor = 484

Total Volume = 380,772 cuft

Hydrograph Discharge Table

Time -- Outflow
(hrs cfs)

11.80	19.67
12.00	59.34
12.20	84.89 <<
12.40	63.99
12.60	38.77
12.80	17.18
13.00	13.49
13.20	11.22
13.40	9.85
13.60	8.82

...End

Hydrograph Report

Page 1

English

Hyd. No. 3

25 YEAR PRE-DEV

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Drainage area = 39.53 ac
Basin Slope = 3.7 %
Tc method = LAG
Total precip. = 6.40 in
Storm duration = 24 hrs

Peak discharge = 100.05 cfs
Time interval = 12 min
Curve number = 72
Hydraulic length = 1670 ft
Time of conc. (Tc) = 31.7 min
Distribution = Type II
Shape factor = 484

Total Volume = 447,084 cuft

Hydrograph Discharge Table

Time -- Outflow
(hrs cfs)

11.80	24.18
12.00	70.79
12.20	100.05 <<
12.40	74.97
12.60	45.05
12.80	19.78
13.00	15.50
13.20	12.88
13.40	11.31
13.60	10.11

...End

Hydrograph Report

Page 1

English

Hyd. No. 4

100 YEAR PRE-DEV

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Drainage area = 39.53 ac
Basin Slope = 3.7 %
Tc method = LAG
Total precip. = 8.00 in
Storm duration = 24 hrs

Peak discharge = 141.70 cfs
Time interval = 12 min
Curve number = 72
Hydraulic length = 1670 ft
Time of conc. (Tc) = 31.7 min
Distribution = Type II
Shape factor = 484

Total Volume = 631,523 cuft

Hydrograph Discharge Table

Time -- Outflow
(hrs cfs)

11.80	37.00
12.00	102.57
12.20	141.70 <<
12.40	104.96
12.60	62.08
12.80	26.77
13.00	20.93
13.20	17.34
13.40	15.20

...End

Hydrograph Report

Page 1

English

Hyd. No. 5

2 YEAR POST-DEV

Hydrograph type = SCS Runoff
Storm frequency = 2 yrs
Drainage area = 39.53 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 3.50 in
Storm duration = 24 hrs

Peak discharge = 53.61 cfs
Time interval = 12 min
Curve number = 82
Hydraulic length = 0 ft
Time of conc. (Tc) = 25 min
Distribution = Type II
Shape factor = 484

Total Volume = 239,807 cuft

Hydrograph Discharge Table

Time -- Outflow (hrs cfs)

11.80	12.79
12.00	37.79
12.20	53.61 <<
12.40	40.24
12.60	24.24
12.80	10.67
13.00	8.37
13.20	6.96
13.40	6.11
13.60	5.46

...End

Hydrograph Report

Page 1

English

Hyd. No. 6

10 YEAR POST-DEV

Hydrograph type = SCS Runoff
Storm frequency = 10 yrs
Drainage area = 39.53 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.80 in
Storm duration = 24 hrs

Peak discharge = 114.34 cfs
Time interval = 12 min
Curve number = 82
Hydraulic length = 0 ft
Time of conc. (Tc) = 25 min
Distribution = Type II
Shape factor = 484

Total Volume = 511,676 cuft

Hydrograph Discharge Table

Time -- Outflow (hrs cfs)

11.60	12.70
11.80	31.89
12.00	84.46
12.20	114.34 <<
12.40	83.83
12.60	48.88
12.80	20.75
13.00	16.17
13.20	13.38
13.40	11.71

...End

Hydrograph Report

Page 1

English

Hyd. No. 7

25 YEAR POST-DEVELOPMENT

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Drainage area = 39.53 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 6.40 in
Storm duration = 24 hrs

Peak discharge = 130.56 cfs
Time interval = 12 min
Curve number = 82
Hydraulic length = 0 ft
Time of conc. (Tc) = 25 min
Distribution = Type II
Shape factor = 484

Total Volume = 586,080 cuft

Hydrograph Discharge Table

Time -- Outflow (hrs cfs)

11.60	15.03
11.80	37.20
12.00	97.09
12.20	130.56 <<
12.40	95.39
12.60	55.36
12.80	23.37
13.00	18.20
13.20	15.05
13.40	13.16

...End

Hydrograph Report

Page 1

English

Hyd. No. 8

100 YEAR POST DEVELOPMENT

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Drainage area = 47.00 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 8.00 in
Storm duration = 24 hrs

Peak discharge = 206.85 cfs
Time interval = 12 min
Curve number = 82
Hydraulic length = 0 ft
Time of conc. (Tc) = 25 min
Distribution = Type II
Shape factor = 484

Total Volume = 937,249 cuft

Hydrograph Discharge Table

Time -- Outflow (hrs cfs)

11.60	25.51
11.80	61.42
12.00	155.84
12.20	206.85 <<
12.40	150.13
12.60	86.32
12.80	36.07
13.00	28.05
13.20	23.16

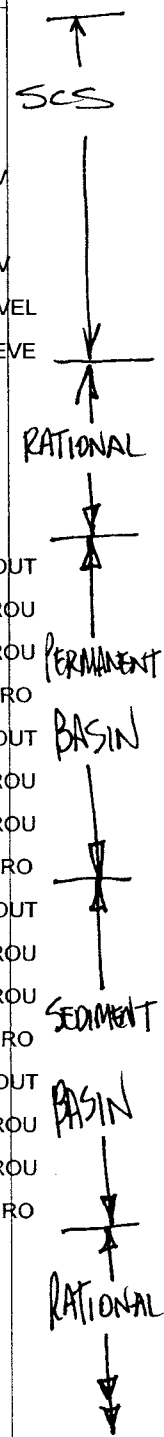
...End

Pond Routings

Hydrograph Summary Report

Page 1

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Return period (yrs)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	31.5	12	732	150,792	2	---	---	---	2 YEAR PRE-DEV
2	SCS Runoff	84.9	12	732	380,772	10	---	---	---	10 YEAR PRE-DEV
3	SCS Runoff	100.0	12	732	447,084	25	---	---	---	25 YEAR PRE-DEV
4	SCS Runoff	141.7	12	732	631,523	100	---	---	---	100 YEAR PRE-DEV
5	SCS Runoff	53.6	12	732	239,807	2	---	---	---	2 YEAR POST-DEV
6	SCS Runoff	114.3	12	732	511,676	10	---	---	---	10 YEAR POST-DEV
7	SCS Runoff	130.6	12	732	586,080	25	---	---	---	25 YEAR POST-DEV
8	SCS Runoff	206.8	12	732	937,249	100	---	---	---	100 YEAR POST DEV
10	Rational	60.3	1	25	135,682	2	---	---	---	2 yr storm
11	Rational	84.6	1	25	190,353	10	---	---	---	10 yr storm
12	Rational	97.6	1	25	219,658	25	---	---	---	25 yr storm
13	Rational	118.3	1	25	266,082	100	---	---	---	100 yr storm
15	Reservoir	29.9	12	756	239,748	2	5	50.18	95,481	2 YR POST DEV ROUT
16	Reservoir	97.0	12	744	511,617	10	6	51.21	130,529	10 YR POST DEV ROU
17	Reservoir	109.0	12	744	586,023	25	7	51.43	138,316	25 YR POST DEV ROU
18	Reservoir	173.7	12	744	937,193	100	8	52.90	192,702	100 YR POST DEV RO
20	Reservoir	28.0	1	52	106,524	2	10	50.14	94,184	2 YR POST DEV ROUT
21	Reservoir	50.1	1	45	161,095	10	11	50.53	107,379	10 YR POST DEV ROU
22	Reservoir	62.1	1	43	190,366	25	12	50.72	113,675	25 YR POST DEV ROU
23	Reservoir	81.2	1	41	236,746	100	13	50.99	122,953	100 YR POST DEV RO
25	Reservoir	40.9	12	744	239,801	2	5	50.38	102,310	2 YR POST DEV ROUT
26	Reservoir	97.9	12	744	511,670	10	6	51.22	130,984	10 YR POST DEV ROU
27	Reservoir	109.1	12	744	586,076	25	7	51.44	138,761	25 YR POST DEV ROU
28	Reservoir	173.7	12	744	937,246	100	8	52.90	192,705	100 YR POST DEV RO
30	Reservoir	38.5	1	43	124,382	2	10	50.34	100,876	2 YR POST DEV ROUT
31	Reservoir	60.0	1	40	179,011	10	11	50.69	112,685	10 YR POST DEV ROU
32	Reservoir	71.7	1	38	208,300	25	12	50.86	118,487	25 YR POST DEV ROU
33	Reservoir	90.0	1	37	254,703	100	13	51.11	127,246	100 YR POST DEV RO
35	Rational	34.3	1	32	98,741	2	---	---	---	2-yr pre
36	Rational	48.6	1	32	140,076	10	---	---	---	10-yr pre
37	Rational	56.5	1	32	162,577	25	---	---	---	25-yr pre



Page 2

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Return period (yrs)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
38	Rational	68.8	1	32	198,266	100	---	-----	-----	100-yr pre

Permanent SWM Facility

Reservoir Report

Page 1

English

Reservoir No. 1 - REVISED POND MARCH 2001

Pond Data

Pond storage is based on known contour areas

Stage / Storage Table

Stage ft	Elevation ft	Contour area sqft	Incr. Storage cuft	Total storage cuft
0.00	46.99	00	0	0
0.01	47.00	26,777	134	134
1.01	48.00	28,942	27,860	27,994
2.01	49.00	30,783	29,863	57,857
3.01	50.00	32,631	31,707	89,564
4.01	51.00	34,550	33,591	123,155
5.01	52.00	36,751	35,651	158,806
6.01	53.00	38,705	37,728	196,534
7.01	54.00	40,847	39,776	236,310

Culvert / Orifice Structures

	[A]	[B]	[C]	[D]
Rise in	= 42.0	4.0	0.0	0.0
Span in	= 42.0	4.0	0.0	0.0
No. Barrels	= 1	1	0	0
Invert El. ft	= 44.14	47.00	0.00	0.00
Length ft	= 45.0	0.5	0.0	0.0
Slope %	= 0.42	0.00	0.00	0.00
N-Value	= .013	.013	.013	.000
Orif. Coeff.	= 0.60	0.60	0.60	0.00
Multi-Stage	= -----	Yes	Yes	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len ft	= 12.5	20.0	0.0	0.0
Crest El. ft	= 49.33	52.00	0.00	0.00
Weir Coeff.	= 3.00	3.00	0.00	0.00
Eqn. Exp.	= 1.50	1.50	0.00	0.00
Multi-Stage	= Yes	No	No	No

Tailwater Elevation = 45.70 ft

Note: All outflows have been analyzed under inlet and outlet control.

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Discharge cfs
0.00	0	46.99	22.69	0.00	---	---	0.00	0.00	---	---	0.00
0.00	13	46.99	46.44	0.00	---	---	0.00	0.00	---	---	0.00
0.00	27	46.99	46.45	0.00	---	---	0.00	0.00	---	---	0.00
0.00	40	46.99	46.47	0.00	---	---	0.00	0.00	---	---	0.00
0.00	54	46.99	46.49	0.00	---	---	0.00	0.00	---	---	0.00
0.00	67	46.99	46.51	0.00	---	---	0.00	0.00	---	---	0.00
0.01	80	47.00	46.53	0.00	---	---	0.00	0.00	---	---	0.00
0.01	94	47.00	46.54	0.00	---	---	0.00	0.00	---	---	0.00
0.01	107	47.00	46.56	0.00	---	---	0.00	0.00	---	---	0.00
0.01	121	47.00	46.58	0.00	---	---	0.00	0.00	---	---	0.00
0.01	134	47.00	46.60	0.00	---	---	0.00	0.00	---	---	0.00

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Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Discharge cfs
0.11	2,920	47.10	49.83	0.02	---	---	0.00	0.00	---	---	0.02
0.21	5,706	47.20	52.89	0.09	---	---	0.00	0.00	---	---	0.09
0.31	8,492	47.30	55.40	0.15	---	---	0.00	0.00	---	---	0.15
0.41	11,278	47.40	57.56	0.20	---	---	0.00	0.00	---	---	0.20
0.51	14,064	47.50	59.30	0.23	---	---	0.00	0.00	---	---	0.23
0.61	16,850	47.60	60.83	0.28	---	---	0.00	0.00	---	---	0.28
0.71	19,636	47.70	62.32	0.31	---	---	0.00	0.00	---	---	0.31
0.81	22,422	47.80	64.01	0.33	---	---	0.00	0.00	---	---	0.33
0.91	25,208	47.90	65.67	0.36	---	---	0.00	0.00	---	---	0.36
1.01	27,994	48.00	67.28	0.38	---	---	0.00	0.00	---	---	0.38
1.11	30,980	48.10	68.86	0.41	---	---	0.00	0.00	---	---	0.41
1.21	33,967	48.20	70.40	0.43	---	---	0.00	0.00	---	---	0.43
1.31	36,953	48.30	71.91	0.45	---	---	0.00	0.00	---	---	0.45
1.41	39,939	48.40	73.38	0.47	---	---	0.00	0.00	---	---	0.47
1.51	42,926	48.50	74.83	0.49	---	---	0.00	0.00	---	---	0.49
1.61	45,912	48.60	76.25	0.50	---	---	0.00	0.00	---	---	0.50
1.71	48,898	48.70	77.65	0.52	---	---	0.00	0.00	---	---	0.52
1.81	51,884	48.80	79.02	0.54	---	---	0.00	0.00	---	---	0.54
1.91	54,871	48.90	80.36	0.55	---	---	0.00	0.00	---	---	0.55
2.01	57,857	49.00	81.69	0.57	---	---	0.00	0.00	---	---	0.57
2.11	61,028	49.10	82.99	0.58	---	---	0.00	0.00	---	---	0.58
2.21	64,198	49.20	84.27	0.60	---	---	0.00	0.00	---	---	0.60
2.31	67,369	49.30	85.53	0.61	---	---	0.00	0.00	---	---	0.61
2.41	70,540	49.40	86.78	0.63	---	---	0.69	0.00	---	---	1.32
2.51	73,711	49.50	88.01	0.64	---	---	2.63	0.00	---	---	3.27
2.61	76,881	49.60	89.22	0.66	---	---	5.26	0.00	---	---	5.92
2.71	80,052	49.70	90.41	0.67	---	---	8.44	0.00	---	---	9.11
2.81	83,223	49.80	91.59	0.68	---	---	12.08	0.00	---	---	12.76
2.91	86,393	49.90	92.75	0.69	---	---	16.14	0.00	---	---	16.83
3.01	89,564	50.00	92.82	0.71	---	---	20.57	0.00	---	---	21.27
3.11	92,923	50.10	94.62	0.72	---	---	25.34	0.00	---	---	26.06
3.21	96,282	50.20	96.16	0.73	---	---	30.43	0.00	---	---	31.16
3.31	99,641	50.30	97.27	0.74	---	---	35.82	0.00	---	---	36.57
3.41	103,000	50.40	98.37	0.76	---	---	41.51	0.00	---	---	42.26
3.51	106,360	50.50	99.45	0.77	---	---	47.46	0.00	---	---	48.22
3.61	109,719	50.60	100.53	0.78	---	---	53.67	0.00	---	---	54.45
3.71	113,078	50.70	101.59	0.78	---	---	60.13	0.00	---	---	60.91
3.81	116,437	50.80	102.64	0.75	---	---	66.83	0.00	---	---	67.59
3.91	119,796	50.90	103.68	0.71	---	---	73.77	0.00	---	---	74.48
4.01	123,155	51.00	104.71	0.67	---	---	80.93	0.00	---	---	81.60
4.11	126,720	51.10	105.73	0.61	---	---	88.31	0.00	---	---	88.92
4.21	130,285	51.20	106.74	0.54	---	---	95.89	0.00	---	---	96.43
4.31	133,850	51.30	107.74	0.44	---	---	103.69	0.00	---	---	104.12
4.41	137,415	51.40	108.73	0.28	---	---	111.68	0.00	---	---	108.73
4.51	140,980	51.50	109.71	0.00	---	---	119.87	0.00	---	---	109.71
4.61	144,546	51.60	110.68	0.00	---	---	128.25	0.00	---	---	110.68
4.71	148,111	51.70	111.65	0.00	---	---	136.82	0.00	---	---	111.65
4.81	151,676	51.80	112.61	0.00	---	---	145.57	0.00	---	---	112.61
4.91	155,241	51.90	113.55	0.00	---	---	154.50	0.00	---	---	113.55
5.01	158,806	52.00	114.50	0.00	---	---	163.61	0.00	---	---	114.50
5.11	162,579	52.10	115.43	0.00	---	---	172.88	1.90	---	---	117.33
5.21	166,352	52.20	116.35	0.00	---	---	182.33	5.37	---	---	121.72
5.31	170,124	52.30	117.27	0.00	---	---	191.94	9.86	---	---	127.13

Continues on next page...

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Discharge cfs
5.41	173,897	52.40	118.18	0.00	---	---	201.71	15.18	---	---	133.36
5.51	177,670	52.50	119.09	0.00	---	---	211.65	21.21	---	---	140.30
5.61	181,443	52.60	119.99	0.00	---	---	221.74	27.88	---	---	147.87
5.71	185,216	52.70	120.88	0.00	---	---	231.99	35.14	---	---	156.01
5.81	188,988	52.80	121.76	0.00	---	---	242.39	42.93	---	---	164.69
5.91	192,761	52.90	122.64	0.00	---	---	252.95	51.23	---	---	173.87
6.01	196,534	53.00	123.51	0.00	---	---	263.65	60.00	---	---	183.51
6.11	200,512	53.10	124.38	0.00	---	---	274.50	69.22	---	---	193.60
6.21	204,489	53.20	125.23	0.00	---	---	285.49	78.87	---	---	204.11
6.31	208,467	53.30	126.09	0.00	---	---	296.63	88.93	---	---	215.02
6.41	212,444	53.40	126.94	0.00	---	---	307.91	99.39	---	---	226.33
6.51	216,422	53.50	127.78	0.00	---	---	319.33	110.23	---	---	238.00
6.61	220,400	53.60	128.62	0.00	---	---	330.88	121.43	---	---	250.05
6.71	224,377	53.70	129.45	0.00	---	---	342.57	132.99	---	---	262.44
6.81	228,355	53.80	130.27	0.00	---	---	354.40	144.90	---	---	275.17
6.91	232,332	53.90	131.09	0.00	---	---	366.36	157.14	---	---	288.23
7.01	236,310	54.00	131.91	0.00	---	---	378.45	169.71	---	---	301.62

...End

Hydrograph Report

Page 1

English

Hyd. No. 15

2 YR POST DEV ROUTED

Hydrograph type = Reservoir
Storm frequency = 2 yrs
Inflow hyd. No. = 5
Max. Elevation = 50.18 ft

Peak discharge = 29.94 cfs
Time interval = 12 min
Reservoir name = REVISED POND MA
Max. Storage = 95,481 cuft

Storage Indication method used.

Total Volume = 239,748 cuft

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Outflow cfs
12.40	40.24	50.07	94.07	0.72	----	----	23.89	----	----	----	24.60
12.60	24.24	50.18	95.80	0.73	----	----	29.22	----	----	----	29.94 <<
12.80	10.67	50.00	92.84	0.71	----	----	20.61	----	----	----	21.32
13.00	8.37	49.82	91.83	0.68	----	----	12.92	----	----	----	13.61
13.20	6.96	49.73	90.72	0.67	----	----	9.39	----	----	----	10.06
13.40	6.11	49.67	90.03	0.66	----	----	7.43	----	----	----	8.09
13.60	5.46	49.63	89.57	0.66	----	----	6.21	----	----	----	6.87
13.80	4.93	49.60	89.24	0.66	----	----	5.32	----	----	----	5.98
14.00	4.49	49.58	88.97	0.65	----	----	4.73	----	----	----	5.38
14.20	4.10	49.56	88.74	0.65	----	----	4.23	----	----	----	4.88
14.40	3.81	49.54	88.55	0.65	----	----	3.81	----	----	----	4.45
14.60	3.61	49.53	88.39	0.65	----	----	3.47	----	----	----	4.11
14.80	3.46	49.52	88.27	0.64	----	----	3.20	----	----	----	3.85
15.00	3.33	49.51	88.18	0.64	----	----	3.00	----	----	----	3.64
15.20	3.20	49.51	88.10	0.64	----	----	2.82	----	----	----	3.47
15.40	3.06	49.50	88.03	0.64	----	----	2.67	----	----	----	3.31
15.60	2.92	49.50	87.95	0.64	----	----	2.54	----	----	----	3.19
15.80	2.78	49.49	87.88	0.64	----	----	2.43	----	----	----	3.07

...End

Hydrograph Report

Page 1

English

Hyd. No. 16

10 YR POST DEV ROUTED

Hydrograph type = Reservoir
Storm frequency = 10 yrs
Inflow hyd. No. = 6
Max. Elevation = 51.21 ft

Peak discharge = 96.95 cfs
Time interval = 12 min
Reservoir name = REVISED POND MA
Max. Storage = 130,529 cuft

Storage Indication method used.

Total Volume = 511,617 cuft

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Outflow cfs
12.00	84.46	50.07	94.07	0.72	----	----	23.87	----	----	----	24.58
12.20	114.34 <<	51.03	105.05	0.65	----	----	83.40	----	----	----	84.05
12.40	83.83	51.21 <<	106.80	0.53	----	----	96.43	----	----	----	96.95 <<
12.60	48.88	50.85	103.11	0.73	----	----	69.96	----	----	----	70.69
12.80	20.75	50.39	98.24	0.75	----	----	40.82	----	----	----	41.58
13.00	16.17	50.07	94.13	0.72	----	----	24.04	----	----	----	24.75
13.20	13.38	49.93	92.77	0.70	----	----	17.33	----	----	----	18.03
13.40	11.71	49.84	92.09	0.69	----	----	13.80	----	----	----	14.49
13.60	10.44	49.79	91.46	0.68	----	----	11.68	----	----	----	12.36
13.80	9.41	49.75	91.00	0.68	----	----	10.26	----	----	----	10.93
14.00	8.54	49.72	90.63	0.67	----	----	9.11	----	----	----	9.78

...End

Hydrograph Report

Page 1

English

Hyd. No. 17

25 YR POST DEV ROUTED

Hydrograph type = Reservoir
Storm frequency = 25 yrs
Inflow hyd. No. = 7
Max. Elevation = 51.43 ft

Peak discharge = 108.98 cfs
Time interval = 12 min
Reservoir name = REVISED POND MA
Max. Storage = 138,316 cuft

Storage Indication method used.

Total Volume = 586,023 cuft

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Outflow cfs
12.00	97.09	50.43	98.65	0.76	----	----	43.03	----	----	----	43.79
12.20	130.56 <<	51.28	107.53	0.46	----	----	102.11	----	----	----	102.56
12.40	95.39	51.43	108.98	0.21	----	----	113.75	----	----	----	108.98 <<
12.60	55.36	51.01	104.84	0.66	----	----	81.91	----	----	----	82.57
12.80	23.37	50.47	99.16	0.76	----	----	45.86	----	----	----	46.63
13.00	18.20	50.13	95.02	0.72	----	----	26.65	----	----	----	27.37
13.20	15.05	49.97	92.80	0.70	----	----	19.34	----	----	----	20.05
13.40	13.16	49.88	92.55	0.69	----	----	15.41	----	----	----	16.11
13.60	11.73	49.83	91.89	0.69	----	----	13.11	----	----	----	13.79
13.80	10.57	49.78	91.40	0.68	----	----	11.49	----	----	----	12.17
14.00	9.59	49.75	91.00	0.68	----	----	10.27	----	----	----	10.94

...End

Hydrograph Report

Page 1

English

Hyd. No. 18

100 YR POST DEV ROUTED

Hydrograph type = Reservoir
Storm frequency = 100 yrs
Inflow hyd. No. = 8
Max. Elevation = 52.90 ft

Peak discharge = 173.72 cfs
Time interval = 12 min
Reservoir name = REVISED POND MA
Max. Storage = 192,702 cuft

Storage Indication method used.

Total Volume = 937,193 cuft

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Outflow cfs
11.60	25.51	49.92	92.77	0.70	----	----	16.87	----	----	----	17.56
11.80	61.42	50.28	97.08	0.74	----	----	34.89	----	----	----	35.63
12.00	155.84	51.19	106.65	0.54	----	----	95.22	----	----	----	95.76
12.20	206.85 <<	52.47	118.78	----	----	----	208.29	19.17	----	----	137.96
12.40	150.13	52.90	122.62	----	----	----	252.78	51.10	----	----	173.72 <<
12.60	86.32	52.29	117.17	----	----	----	190.92	9.38	----	----	126.55
12.80	36.07	51.25	107.25	0.48	----	----	99.86	----	----	----	100.34
13.00	28.05	50.42	98.53	0.76	----	----	42.42	----	----	----	43.17
13.20	23.16	50.18	95.84	0.73	----	----	29.36	----	----	----	30.09
13.40	20.24	50.06	93.94	0.71	----	----	23.52	----	----	----	24.23
13.60	18.03	49.99	92.81	0.71	----	----	20.08	----	----	----	20.78
13.80	16.23	49.93	92.78	0.70	----	----	17.63	----	----	----	18.33

...End

Hydrograph Report

Page 1

English

Hyd. No. 20

2 YR POST DEV ROUTED

Hydrograph type = Reservoir
Storm frequency = 2 yrs
Inflow hyd. No. = 10
Max. Elevation = 50.14 ft

Peak discharge = 27.97 cfs
Time interval = 1 min
Reservoir name = REVISED POND MA
Max. Storage = 94,184 cuft

Storage Indication method used.

Total Volume = 106,524 cuft

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Outflow cfs
0.57	49.45	49.51	88.17	0.64	----	----	2.99	----	----	----	3.63
0.58	48.24	49.60	89.18	0.65	----	----	5.19	----	----	----	5.84
0.60	47.04	49.67	90.10	0.67	----	----	7.61	----	----	----	8.28
0.62	45.83	49.74	90.93	0.67	----	----	10.04	----	----	----	10.71
0.63	44.62	49.81	91.67	0.68	----	----	12.37	----	----	----	13.05
0.65	43.42	49.86	92.33	0.69	----	----	14.66	----	----	----	15.35
0.67	42.21	49.91	92.76	0.70	----	----	16.73	----	----	----	17.43
0.68	41.01	49.96	92.79	0.70	----	----	18.68	----	----	----	19.38
0.70	39.80	50.00	92.82	0.71	----	----	20.37	----	----	----	21.08
0.72	38.59	50.03	93.30	0.71	----	----	21.85	----	----	----	22.56
0.73	37.39	50.05	93.78	0.71	----	----	23.11	----	----	----	23.82
0.75	36.18	50.08	94.18	0.72	----	----	24.17	----	----	----	24.88
0.77	34.98	50.09	94.51	0.72	----	----	25.04	----	----	----	25.76
0.78	33.77	50.11	94.75	0.72	----	----	25.77	----	----	----	26.49
0.80	32.56	50.12	94.93	0.72	----	----	26.35	----	----	----	27.08
0.82	31.36	50.13	95.06	0.72	----	----	26.78	----	----	----	27.50
0.83	30.15	50.13	95.14	0.72	----	----	27.06	----	----	----	27.78
0.85	28.95	50.14	95.19	0.72	----	----	27.21	----	----	----	27.94
0.87	27.74	50.14	95.20	0.72	----	----	27.25	----	----	----	27.97 <<
0.88	26.53	50.14	95.18	0.72	----	----	27.18	----	----	----	27.90
0.90	25.33	50.13	95.13	0.72	----	----	27.01	----	----	----	27.73
0.92	24.12	50.13	95.05	0.72	----	----	26.74	----	----	----	27.47
0.93	22.92	50.12	94.94	0.72	----	----	26.40	----	----	----	27.12
0.95	21.71	50.11	94.82	0.72	----	----	25.98	----	----	----	26.70
0.97	20.50	50.10	94.67	0.72	----	----	25.50	----	----	----	26.22
0.98	19.30	50.09	94.48	0.72	----	----	24.97	----	----	----	25.69
1.00	18.09	50.08	94.27	0.72	----	----	24.40	----	----	----	25.11
1.02	16.88	50.07	94.03	0.72	----	----	23.77	----	----	----	24.49
1.03	15.68	50.05	93.78	0.71	----	----	23.10	----	----	----	23.82
1.05	14.47	50.04	93.51	0.71	----	----	22.39	----	----	----	23.10
1.07	13.27	50.02	93.22	0.71	----	----	21.63	----	----	----	22.34
1.08	12.06	50.01	92.92	0.71	----	----	20.84	----	----	----	21.55
1.10	10.85	49.99	92.81	0.71	----	----	20.03	----	----	----	20.73
1.12	9.65	49.97	92.80	0.70	----	----	19.18	----	----	----	19.89
1.13	8.44	49.95	92.79	0.70	----	----	18.31	----	----	----	19.01
1.15	7.24	49.93	92.77	0.70	----	----	17.41	----	----	----	18.11

Continues on next page...

Hydrograph Report

Page 1

English

Hyd. No. 21

10 YR POST DEV ROUTED

Hydrograph type = Reservoir
Storm frequency = 10 yrs
Inflow hyd. No. = 11
Max. Elevation = 50.53 ft

Peak discharge = 50.11 cfs
Time interval = 1 min
Reservoir name = REVISED POND MA
Max. Storage = 107,379 cuft

Storage Indication method used.

Total Volume = 161,095 cuft

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Outflow cfs
0.47	79.53	49.62	89.45	0.66	----	----	5.87	----	----	----	6.52
0.48	77.83	49.75	91.02	0.68	----	----	10.31	----	----	----	10.99
0.50	76.14	49.87	92.43	0.69	----	----	14.99	----	----	----	15.68
0.52	74.45	49.98	92.81	0.70	----	----	19.69	----	----	----	20.39
0.53	72.76	50.07	94.13	0.72	----	----	24.02	----	----	----	24.74
0.55	71.07	50.15	95.44	0.73	----	----	28.04	----	----	----	28.77
0.57	69.37	50.22	96.43	0.73	----	----	31.72	----	----	----	32.45
0.58	67.68	50.29	97.11	0.74	----	----	35.03	----	----	----	35.77
0.60	65.99	50.34	97.69	0.75	----	----	37.99	----	----	----	38.74
0.62	64.30	50.38	98.18	0.75	----	----	40.54	----	----	----	41.29
0.63	62.60	50.42	98.59	0.76	----	----	42.73	----	----	----	43.49
0.65	60.91	50.45	98.93	0.76	----	----	44.58	----	----	----	45.34
0.67	59.22	50.48	99.20	0.76	----	----	46.06	----	----	----	46.83
0.68	57.53	50.50	99.41	0.77	----	----	47.23	----	----	----	48.00
0.70	55.84	50.51	99.57	0.77	----	----	48.13	----	----	----	48.90
0.72	54.14	50.52	99.68	0.77	----	----	48.77	----	----	----	49.54
0.73	52.45	50.53	99.75	0.77	----	----	49.17	----	----	----	49.94
0.75	50.76	50.53	99.78	0.77	----	----	49.34	----	----	----	50.11 <<
0.77	49.07	50.53	99.77	0.77	----	----	49.32	----	----	----	50.09
0.78	47.38	50.53	99.74	0.77	----	----	49.13	----	----	----	49.90
0.80	45.68	50.52	99.68	0.77	----	----	48.77	----	----	----	49.54
0.82	43.99	50.51	99.59	0.77	----	----	48.28	----	----	----	49.05
0.83	42.30	50.50	99.49	0.77	----	----	47.66	----	----	----	48.43
0.85	40.61	50.49	99.36	0.77	----	----	46.95	----	----	----	47.71
0.87	38.92	50.48	99.21	0.76	----	----	46.14	----	----	----	46.91
0.88	37.22	50.46	99.05	0.76	----	----	45.25	----	----	----	46.01
0.90	35.53	50.45	98.87	0.76	----	----	44.28	----	----	----	45.04
0.92	33.84	50.43	98.68	0.76	----	----	43.23	----	----	----	43.99
0.93	32.15	50.41	98.48	0.76	----	----	42.12	----	----	----	42.88
0.95	30.46	50.39	98.27	0.75	----	----	40.98	----	----	----	41.73
0.97	28.76	50.37	98.04	0.75	----	----	39.81	----	----	----	40.56
0.98	27.07	50.35	97.80	0.75	----	----	38.59	----	----	----	39.34
1.00	25.38	50.33	97.56	0.75	----	----	37.32	----	----	----	38.07
1.02	23.69	50.30	97.31	0.74	----	----	36.02	----	----	----	36.76
1.03	22.00	50.28	97.05	0.74	----	----	34.73	----	----	----	35.47
1.05	20.30	50.26	96.77	0.74	----	----	33.41	----	----	----	34.15

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Hydrograph Report

Page 1

English

Hyd. No. 22

25 YR POST DEV ROUTED

Hydrograph type = Reservoir
Storm frequency = 25 yrs
Inflow hyd. No. = 12
Max. Elevation = 50.72 ft

Peak discharge = 62.10 cfs
Time interval = 1 min
Reservoir name = REVISED POND MA
Max. Storage = 113,675 cuft

Storage indication method used.

Total Volume = 190,366 cuft

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Outflow cfs
0.43	95.67	49.64	89.76	0.66	----	----	6.69	----	----	----	7.35
0.45	93.72	49.80	91.65	0.68	----	----	12.28	----	----	----	12.97
0.47	91.77	49.95	92.79	0.70	----	----	18.36	----	----	----	19.06
0.48	89.82	50.08	94.19	0.72	----	----	24.19	----	----	----	24.90
0.50	87.86	50.19	95.93	0.73	----	----	29.67	----	----	----	30.40
0.52	85.91	50.28	97.07	0.74	----	----	34.82	----	----	----	35.56
0.53	83.96	50.37	97.99	0.75	----	----	39.54	----	----	----	40.29
0.55	82.01	50.44	98.78	0.76	----	----	43.76	----	----	----	44.52
0.57	80.05	50.50	99.45	0.77	----	----	47.44	----	----	----	48.21
0.58	78.10	50.55	100.01	0.77	----	----	50.69	----	----	----	51.46
0.60	76.15	50.60	100.48	0.78	----	----	53.39	----	----	----	54.16
0.62	74.20	50.63	100.85	0.78	----	----	55.67	----	----	----	56.45
0.63	72.24	50.66	101.15	0.78	----	----	57.50	----	----	----	58.28
0.65	70.29	50.68	101.39	0.78	----	----	58.92	----	----	----	59.70
0.67	68.34	50.70	101.56	0.78	----	----	59.97	----	----	----	60.74
0.68	66.39	50.71	101.68	0.78	----	----	60.71	----	----	----	61.48
0.70	64.43	50.72	101.75	0.77	----	----	61.15	----	----	----	61.93
0.72	62.48	50.72	101.77	0.77	----	----	61.32	----	----	----	62.10 <<
0.73	60.53	50.72	101.76	0.77	----	----	61.26	----	----	----	62.03
0.75	58.58	50.71	101.72	0.78	----	----	60.98	----	----	----	61.75
0.77	56.62	50.71	101.65	0.78	----	----	60.51	----	----	----	61.29
0.78	54.67	50.70	101.55	0.78	----	----	59.88	----	----	----	60.66
0.80	52.72	50.68	101.42	0.78	----	----	59.12	----	----	----	59.90
0.82	50.77	50.67	101.27	0.78	----	----	58.23	----	----	----	59.01
0.83	48.81	50.65	101.11	0.78	----	----	57.22	----	----	----	58.00
0.85	46.86	50.64	100.93	0.78	----	----	56.11	----	----	----	56.89
0.87	44.91	50.62	100.73	0.78	----	----	54.91	----	----	----	55.69
0.88	42.96	50.60	100.52	0.78	----	----	53.63	----	----	----	54.41
0.90	41.00	50.58	100.29	0.78	----	----	52.32	----	----	----	53.10
0.92	39.05	50.56	100.06	0.77	----	----	50.95	----	----	----	51.72
0.93	37.10	50.53	99.81	0.77	----	----	49.52	----	----	----	50.29
0.95	35.15	50.51	99.55	0.77	----	----	48.03	----	----	----	48.79
0.97	33.19	50.48	99.28	0.77	----	----	46.53	----	----	----	47.29
0.98	31.24	50.46	99.01	0.76	----	----	45.01	----	----	----	45.77
1.00	29.29	50.43	98.72	0.76	----	----	43.44	----	----	----	44.20
1.02	27.34	50.41	98.43	0.76	----	----	41.84	----	----	----	42.59

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Hydrograph Report

Page 1

English

Hyd. No. 23

100 YR POST DEV ROUTED

Hydrograph type = Reservoir
Storm frequency = 100 yrs
Inflow hyd. No. = 13
Max. Elevation = 50.99 ft

Peak discharge = 81.17 cfs
Time interval = 1 min
Reservoir name = REVISED POND MA
Max. Storage = 122,953 cuft

Storage Indication method used.

Total Volume = 236,746 cuft

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Outflow cfs
0.40	113.53	49.73	90.72	0.67	----	----	9.39	----	----	----	10.07
0.42	118.26 <<	49.92	92.77	0.70	----	----	16.99	----	----	----	17.69
0.43	115.89	50.09	94.52	0.72	----	----	25.06	----	----	----	25.77
0.45	113.53	50.25	96.67	0.74	----	----	32.91	----	----	----	33.64
0.47	111.16	50.38	98.15	0.75	----	----	40.36	----	----	----	41.11
0.48	108.80	50.50	99.42	0.77	----	----	47.26	----	----	----	48.03
0.50	106.43	50.60	100.50	0.78	----	----	53.51	----	----	----	54.29
0.52	104.07	50.68	101.41	0.78	----	----	59.07	----	----	----	59.85
0.53	101.70	50.76	102.18	0.76	----	----	63.89	----	----	----	64.66
0.55	99.34	50.82	102.81	0.74	----	----	67.98	----	----	----	68.73
0.57	96.97	50.87	103.32	0.73	----	----	71.42	----	----	----	72.14
0.58	94.61	50.91	103.74	0.71	----	----	74.19	----	----	----	74.90
0.60	92.24	50.94	104.06	0.70	----	----	76.42	----	----	----	77.11
0.62	89.88	50.96	104.30	0.69	----	----	78.09	----	----	----	78.78
0.63	87.51	50.98	104.47	0.68	----	----	79.29	----	----	----	79.96
0.65	85.15	50.99	104.58	0.67	----	----	80.05	----	----	----	80.72
0.67	82.78	50.99	104.64	0.67	----	----	80.44	----	----	----	81.11
0.68	80.42	50.99 <<	104.65	0.67	----	----	80.50	----	----	----	81.17 <<
0.70	78.05	50.99	104.61	0.67	----	----	80.27	----	----	----	80.94
0.72	75.69	50.98	104.54	0.67	----	----	79.78	----	----	----	80.45
0.73	73.32	50.97	104.44	0.68	----	----	79.06	----	----	----	79.74
0.75	70.96	50.96	104.31	0.69	----	----	78.15	----	----	----	78.83
0.77	68.59	50.95	104.15	0.69	----	----	77.06	----	----	----	77.75
0.78	66.22	50.93	103.97	0.70	----	----	75.81	----	----	----	76.51
0.80	63.86	50.91	103.77	0.71	----	----	74.43	----	----	----	75.14
0.82	61.49	50.89	103.56	0.72	----	----	72.96	----	----	----	73.68
0.83	59.13	50.87	103.32	0.73	----	----	71.40	----	----	----	72.13
0.85	56.76	50.84	103.07	0.74	----	----	69.75	----	----	----	70.48
0.87	54.40	50.82	102.81	0.74	----	----	68.01	----	----	----	68.75
0.88	52.03	50.79	102.54	0.75	----	----	66.22	----	----	----	66.97
0.90	49.67	50.76	102.26	0.76	----	----	64.39	----	----	----	65.16
0.92	47.30	50.74	101.96	0.77	----	----	62.51	----	----	----	63.28
0.93	44.94	50.71	101.66	0.78	----	----	60.57	----	----	----	61.35
0.95	42.57	50.68	101.34	0.78	----	----	58.64	----	----	----	59.42
0.97	40.21	50.65	101.02	0.78	----	----	56.67	----	----	----	57.45
0.98	37.84	50.62	100.69	0.78	----	----	54.66	----	----	----	55.44

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Temporary Sediment Basin

Reservoir Report

Page 1

English

Reservoir No. 2 - REVISED E&S POND

Pond Data

Pond storage is based on known contour areas

Stage / Storage Table

Stage ft	Elevation ft	Contour area sqft	Incr. Storage cuft	Total storage cuft
0.00	46.99	00	0	0
0.01	47.00	26,777	134	134
1.01	48.00	28,942	27,860	27,994
2.01	49.00	30,783	29,863	57,857
3.01	50.00	32,631	31,707	89,564
4.01	51.00	34,550	33,591	123,155
5.01	52.00	36,751	35,651	158,806
6.01	53.00	38,705	37,728	196,534
7.01	54.00	40,847	39,776	236,310

Culvert / Orifice Structures

	[A]	[B]	[C]	[D]
Rise in	= 42.0	4.0	0.0	0.0
Span in	= 42.0	4.0	0.0	0.0
No. Barrels	= 1	1	0	0
Invert El. ft	= 44.14	48.20	0.00	0.00
Length ft	= 45.0	0.5	0.0	0.0
Slope %	= 0.42	0.00	0.00	0.00
N-Value	= .013	.013	.013	.000
Orif. Coeff.	= 0.60	0.60	0.60	0.00
Multi-Stage	= ----	Yes	Yes	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len ft	= 12.5	20.0	0.0	0.0
Crest El. ft	= 49.33	52.00	0.00	0.00
Weir Coeff.	= 3.00	3.00	0.00	0.00
Eqn. Exp.	= 1.50	1.50	0.00	0.00
Multi-Stage	= Yes	No	No	No

Tailwater Elevation = 45.70 ft

Note: All outflows have been analyzed under inlet and outlet control.

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Discharge cfs
0.00	0	46.99	22.69	0.00	---	---	0.00	0.00	---	---	0.00
0.00	13	46.99	46.44	0.00	---	---	0.00	0.00	---	---	0.00
0.00	27	46.99	46.45	0.00	---	---	0.00	0.00	---	---	0.00
0.00	40	46.99	46.47	0.00	---	---	0.00	0.00	---	---	0.00
0.00	54	46.99	46.49	0.00	---	---	0.00	0.00	---	---	0.00
0.00	67	46.99	46.51	0.00	---	---	0.00	0.00	---	---	0.00
0.01	80	47.00	46.53	0.00	---	---	0.00	0.00	---	---	0.00
0.01	94	47.00	46.54	0.00	---	---	0.00	0.00	---	---	0.00
0.01	107	47.00	46.56	0.00	---	---	0.00	0.00	---	---	0.00
0.01	121	47.00	46.58	0.00	---	---	0.00	0.00	---	---	0.00
0.01	134	47.00	46.60	0.00	---	---	0.00	0.00	---	---	0.00

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Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Discharge cfs
0.11	2,920	47.10	49.83	0.00	---	---	0.00	0.00	---	---	0.00
0.21	5,706	47.20	52.89	0.00	---	---	0.00	0.00	---	---	0.00
0.31	8,492	47.30	55.40	0.00	---	---	0.00	0.00	---	---	0.00
0.41	11,278	47.40	57.56	0.00	---	---	0.00	0.00	---	---	0.00
0.51	14,064	47.50	59.30	0.00	---	---	0.00	0.00	---	---	0.00
0.61	16,850	47.60	60.83	0.00	---	---	0.00	0.00	---	---	0.00
0.71	19,636	47.70	62.32	0.00	---	---	0.00	0.00	---	---	0.00
0.81	22,422	47.80	64.01	0.00	---	---	0.00	0.00	---	---	0.00
0.91	25,208	47.90	65.67	0.00	---	---	0.00	0.00	---	---	0.00
1.01	27,994	48.00	67.28	0.00	---	---	0.00	0.00	---	---	0.00
1.11	30,980	48.10	68.86	0.00	---	---	0.00	0.00	---	---	0.00
1.21	33,967	48.20	70.40	0.00	---	---	0.00	0.00	---	---	0.00
1.31	36,953	48.30	71.91	0.02	---	---	0.00	0.00	---	---	0.02
1.41	39,939	48.40	73.38	0.09	---	---	0.00	0.00	---	---	0.09
1.51	42,926	48.50	74.83	0.15	---	---	0.00	0.00	---	---	0.15
1.61	45,912	48.60	76.25	0.20	---	---	0.00	0.00	---	---	0.20
1.71	48,898	48.70	77.65	0.23	---	---	0.00	0.00	---	---	0.23
1.81	51,884	48.80	79.02	0.28	---	---	0.00	0.00	---	---	0.28
1.91	54,871	48.90	80.36	0.31	---	---	0.00	0.00	---	---	0.31
2.01	57,857	49.00	81.69	0.33	---	---	0.00	0.00	---	---	0.33
2.11	61,028	49.10	82.99	0.36	---	---	0.00	0.00	---	---	0.36
2.21	64,198	49.20	84.27	0.38	---	---	0.00	0.00	---	---	0.38
2.31	67,369	49.30	85.53	0.41	---	---	0.00	0.00	---	---	0.41
2.41	70,540	49.40	86.78	0.43	---	---	0.69	0.00	---	---	1.12
2.51	73,711	49.50	88.01	0.45	---	---	2.63	0.00	---	---	3.08
2.61	76,881	49.60	89.22	0.47	---	---	5.26	0.00	---	---	5.73
2.71	80,052	49.70	90.41	0.49	---	---	8.44	0.00	---	---	8.92
2.81	83,223	49.80	91.59	0.50	---	---	12.08	0.00	---	---	12.59
2.91	86,393	49.90	92.76	0.52	---	---	16.14	0.00	---	---	16.66
3.01	89,564	50.00	92.82	0.54	---	---	20.57	0.00	---	---	21.10
3.11	92,923	50.10	94.62	0.55	---	---	25.34	0.00	---	---	25.89
3.21	96,282	50.20	96.16	0.57	---	---	30.43	0.00	---	---	31.00
3.31	99,641	50.30	97.27	0.58	---	---	35.82	0.00	---	---	36.41
3.41	103,000	50.40	98.37	0.60	---	---	41.51	0.00	---	---	42.10
3.51	106,360	50.50	99.45	0.61	---	---	47.46	0.00	---	---	48.07
3.61	109,719	50.60	100.53	0.63	---	---	53.67	0.00	---	---	54.30
3.71	113,078	50.70	101.59	0.64	---	---	60.13	0.00	---	---	60.77
3.81	116,437	50.80	102.64	0.66	---	---	66.83	0.00	---	---	67.49
3.91	119,796	50.90	103.68	0.67	---	---	73.77	0.00	---	---	74.44
4.01	123,155	51.00	104.71	0.67	---	---	80.93	0.00	---	---	81.60
4.11	126,720	51.10	105.73	0.61	---	---	88.31	0.00	---	---	88.92
4.21	130,285	51.20	106.74	0.54	---	---	95.89	0.00	---	---	96.43
4.31	133,850	51.30	107.74	0.44	---	---	103.69	0.00	---	---	104.12
4.41	137,415	51.40	108.73	0.28	---	---	111.68	0.00	---	---	108.73
4.51	140,980	51.50	109.71	0.00	---	---	119.87	0.00	---	---	109.71
4.61	144,546	51.60	110.68	0.00	---	---	128.25	0.00	---	---	110.68
4.71	148,111	51.70	111.65	0.00	---	---	136.82	0.00	---	---	111.65
4.81	151,676	51.80	112.61	0.00	---	---	145.57	0.00	---	---	112.61
4.91	155,241	51.90	113.55	0.00	---	---	154.50	0.00	---	---	113.55
5.01	158,806	52.00	114.49	0.00	---	---	163.61	0.00	---	---	114.49
5.11	162,579	52.10	115.43	0.00	---	---	172.88	1.90	---	---	117.33
5.21	166,352	52.20	116.35	0.00	---	---	182.33	5.37	---	---	121.72
5.31	170,124	52.30	117.27	0.00	---	---	191.94	9.86	---	---	127.13

Continues on next page...

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Discharge cfs
5.41	173,897	52.40	118.18	0.00	---	---	201.71	15.18	---	---	133.36
5.51	177,670	52.50	119.09	0.00	---	---	211.65	21.21	---	---	140.30
5.61	181,443	52.60	119.98	0.00	---	---	221.74	27.88	---	---	147.87
5.71	185,216	52.70	120.88	0.00	---	---	231.99	35.14	---	---	156.01
5.81	188,988	52.80	121.76	0.00	---	---	242.39	42.93	---	---	164.69
5.91	192,761	52.90	122.64	0.00	---	---	252.95	51.23	---	---	173.87
6.01	196,534	53.00	123.51	0.00	---	---	263.65	60.00	---	---	183.51
6.11	200,512	53.10	124.38	0.00	---	---	274.50	69.22	---	---	193.60
6.21	204,489	53.20	125.23	0.00	---	---	285.49	78.87	---	---	204.11
6.31	208,467	53.30	126.09	0.00	---	---	296.63	88.93	---	---	215.02
6.41	212,444	53.40	126.94	0.00	---	---	307.91	99.39	---	---	226.33
6.51	216,422	53.50	127.78	0.00	---	---	319.33	110.23	---	---	238.00
6.61	220,400	53.60	128.62	0.00	---	---	330.88	121.43	---	---	250.05
6.71	224,377	53.70	129.45	0.00	---	---	342.57	132.99	---	---	262.44
6.81	228,355	53.80	130.27	0.00	---	---	354.40	144.90	---	---	275.17
6.91	232,332	53.90	131.09	0.00	---	---	366.36	157.14	---	---	288.23
7.01	236,310	54.00	131.91	0.00	---	---	378.45	169.71	---	---	301.62

...End

Hydrograph Report

Page 1

English

Hyd. No. 25

2 YR POST DEV ROUTED

Hydrograph type = Reservoir
Storm frequency = 2 yrs
Inflow hyd. No. = 5
Max. Elevation = 50.38 ft

Peak discharge = 40.93 cfs
Time interval = 12 min
Reservoir name = REVISED E&S PON
Max. Storage = 102,310 cuft

Storage Indication method used.

Total Volume = 239,801 cuft

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Outflow cfs
12.20	53.61 <<	50.08	94.24	0.55	----	----	24.34	----	----	----	24.89
12.40	40.24	50.38 <<	98.14	0.60	----	----	40.34	----	----	----	40.93 <<
12.60	24.24	50.26	96.86	0.58	----	----	33.83	----	----	----	34.41
12.80	10.67	50.03	93.32	0.54	----	----	21.90	----	----	----	22.44
13.00	8.37	49.83	91.97	0.51	----	----	13.42	----	----	----	13.93
13.20	6.96	49.73	90.81	0.49	----	----	9.66	----	----	----	10.15
13.40	6.11	49.67	90.11	0.48	----	----	7.63	----	----	----	8.11
13.60	5.46	49.64	89.65	0.47	----	----	6.40	----	----	----	6.87
13.80	4.93	49.61	89.31	0.47	----	----	5.51	----	----	----	5.98
14.00	4.49	49.59	89.05	0.46	----	----	4.90	----	----	----	5.36
14.20	4.10	49.57	88.83	0.46	----	----	4.41	----	----	----	4.87
14.40	3.81	49.55	88.63	0.46	----	----	3.99	----	----	----	4.45
14.60	3.61	49.54	88.48	0.45	----	----	3.65	----	----	----	4.11

...End

Hydrograph Report

Page 1

English

Hyd. No. 26

10 YR POST DEV ROUTED

Hydrograph type = Reservoir
Storm frequency = 10 yrs
Inflow hyd. No. = 6
Max. Elevation = 51.22 ft

Peak discharge = 97.94 cfs
Time interval = 12 min
Reservoir name = REVISED E&S PON
Max. Storage = 130,984 cuft

Storage Indication method used.

Total Volume = 511,670 cuft

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Outflow cfs
11.80	31.89	49.85	92.14	0.51	----	----	13.98	----	----	----	14.50
12.00	84.46	50.46	99.00	0.61	----	----	44.98	----	----	----	45.59
12.20	114.34 <<	51.12	105.95	0.59	----	----	89.99	----	----	----	90.58
12.40	83.83	51.22 <<	106.93	0.52	----	----	97.42	----	----	----	97.94 <<
12.60	48.88	50.85	103.13	0.66	----	----	70.11	----	----	----	70.77
12.80	20.75	50.39	98.26	0.60	----	----	40.93	----	----	----	41.53
13.00	16.17	50.08	94.18	0.55	----	----	24.17	----	----	----	24.72
13.20	13.38	49.93	92.77	0.53	----	----	17.48	----	----	----	18.01
13.40	11.71	49.85	92.13	0.51	----	----	13.96	----	----	----	14.47
13.60	10.44	49.79	91.51	0.50	----	----	11.84	----	----	----	12.34
13.80	9.41	49.75	91.06	0.49	----	----	10.43	----	----	----	10.92

...End

Hydrograph Report

Page 1

English

Hyd. No. 27

25 YR POST DEV ROUTED

Hydrograph type = Reservoir
Storm frequency = 25 yrs
Inflow hyd. No. = 7
Max. Elevation = 51.44 ft

Peak discharge = 109.10 cfs
Time interval = 12 min
Reservoir name = REVISED E&S PON
Max. Storage = 138,761 cuft

Storage Indication method used.

Total Volume = 586,076 cuft

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Outflow cfs
11.80	37.20	49.97	92.80	0.53	----	----	19.28	----	----	----	19.81
12.00	97.09	50.61	100.64	0.63	----	----	54.34	----	----	----	54.97
12.20	130.56 <<	51.32	107.91	0.41	----	----	105.06	----	----	----	104.91
12.40	95.39	51.44 <<	109.10	0.18	----	----	114.77	----	----	----	109.10 <<
12.60	55.36	51.02	104.91	0.66	----	----	82.39	----	----	----	83.04
12.80	23.37	50.48	99.19	0.61	----	----	45.99	----	----	----	46.60
13.00	18.20	50.13	95.06	0.56	----	----	26.78	----	----	----	27.34
13.20	15.05	49.98	92.80	0.53	----	----	19.49	----	----	----	20.03
13.40	13.16	49.89	92.59	0.52	----	----	15.57	----	----	----	16.09
13.60	11.73	49.83	91.93	0.51	----	----	13.28	----	----	----	13.79
13.80	10.57	49.79	91.45	0.50	----	----	11.65	----	----	----	12.15
14.00	9.59	49.75	91.06	0.49	----	----	10.44	----	----	----	10.93

...End

Hydrograph Report

Page 1

English

Hyd. No. 28

100 YR POST DEV ROUTED

Hydrograph type = Reservoir
Storm frequency = 100 yrs
Inflow hyd. No. = 8
Max. Elevation = 52.90 ft

Peak discharge = 173.73 cfs
Time interval = 12 min
Reservoir name = REVISED E&S PON
Max. Storage = 192,705 cuft

Storage Indication method used.

Total Volume = 937,246 cuft

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Outflow cfs
11.60	25.51	49.96	92.79	0.53	----	----	18.58	----	----	----	19.11
11.80	61.42	50.30	97.23	0.58	----	----	35.63	----	----	----	36.21
12.00	155.84	51.20	106.69	0.54	----	----	95.53	----	----	----	96.07
12.20	206.85 <<	52.47	118.79	----	----	----	208.35	19.21	----	----	137.99
12.40	150.13	52.90 <<	122.62	----	----	----	252.79	51.10	----	----	173.73 <<
12.60	86.32	52.29	117.17	----	----	----	190.92	9.38	----	----	126.55
12.80	36.07	51.25	107.25	0.48	----	----	99.86	----	----	----	100.34
13.00	28.05	50.42	98.54	0.60	----	----	42.48	----	----	----	43.08
13.20	23.16	50.18	95.88	0.57	----	----	29.48	----	----	----	30.05
13.40	20.24	50.06	93.99	0.55	----	----	23.67	----	----	----	24.21
13.60	18.03	49.99	92.81	0.54	----	----	20.24	----	----	----	20.77
13.80	16.23	49.94	92.78	0.53	----	----	17.80	----	----	----	18.33

...End

Hydrograph Report

Page 1

English

Hyd. No. 30

2 YR POST DEV ROUTED

Hydrograph type = Reservoir
Storm frequency = 2 yrs
Inflow hyd. No. = 10
Max. Elevation = 50.34 ft

Peak discharge = 38.50 cfs
Time interval = 1 min
Reservoir name = REVISED E&S PON
Max. Storage = 100,876 cuft

Storage Indication method used.

Total Volume = 124,382 cuft

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Outflow cfs
0.40	57.89	49.55	88.56	0.46	----	----	3.83	----	----	----	4.28
0.42	60.30 <<	49.65	89.77	0.48	----	----	6.74	----	----	----	7.21
0.43	59.10	49.74	90.92	0.49	----	----	10.00	----	----	----	10.49
0.45	57.89	49.83	91.94	0.51	----	----	13.32	----	----	----	13.82
0.47	56.69	49.91	92.76	0.52	----	----	16.56	----	----	----	17.08
0.48	55.48	49.98	92.81	0.53	----	----	19.70	----	----	----	20.23
0.50	54.27	50.04	93.56	0.54	----	----	22.51	----	----	----	23.06
0.52	53.07	50.09	94.50	0.55	----	----	25.02	----	----	----	25.57
0.53	51.86	50.14	95.23	0.56	----	----	27.34	----	----	----	27.90
0.55	50.65	50.18	95.84	0.57	----	----	29.37	----	----	----	29.93
0.57	49.45	50.21	96.31	0.57	----	----	31.16	----	----	----	31.73
0.58	48.24	50.24	96.64	0.58	----	----	32.73	----	----	----	33.31
0.60	47.04	50.27	96.91	0.58	----	----	34.05	----	----	----	34.63
0.62	45.83	50.29	97.13	0.58	----	----	35.13	----	----	----	35.72
0.63	44.62	50.30	97.31	0.58	----	----	36.02	----	----	----	36.60
0.65	43.42	50.32	97.45	0.59	----	----	36.73	----	----	----	37.32
0.67	42.21	50.33	97.55	0.59	----	----	37.26	----	----	----	37.85
0.68	41.01	50.33	97.62	0.59	----	----	37.63	----	----	----	38.22
0.70	39.80	50.34	97.66	0.59	----	----	37.84	----	----	----	38.43
0.72	38.59	50.34 <<	97.67	0.59	----	----	37.91	----	----	----	38.50 <<
0.73	37.39	50.34	97.66	0.59	----	----	37.86	----	----	----	38.45
0.75	36.18	50.33	97.63	0.59	----	----	37.70	----	----	----	38.29
0.77	34.98	50.33	97.58	0.59	----	----	37.44	----	----	----	38.03
0.78	33.77	50.32	97.52	0.59	----	----	37.09	----	----	----	37.67
0.80	32.56	50.31	97.43	0.59	----	----	36.65	----	----	----	37.24
0.82	31.36	50.31	97.33	0.59	----	----	36.14	----	----	----	36.73
0.83	30.15	50.30	97.22	0.58	----	----	35.58	----	----	----	36.16
0.85	28.95	50.28	97.10	0.58	----	----	34.97	----	----	----	35.55
0.87	27.74	50.27	96.96	0.58	----	----	34.31	----	----	----	34.89
0.88	26.53	50.26	96.81	0.58	----	----	33.60	----	----	----	34.17
0.90	25.33	50.24	96.66	0.58	----	----	32.84	----	----	----	33.41
0.92	24.12	50.23	96.49	0.57	----	----	32.04	----	----	----	32.61
0.93	22.92	50.21	96.32	0.57	----	----	31.20	----	----	----	31.77
0.95	21.71	50.20	96.13	0.57	----	----	30.34	----	----	----	30.91
0.97	20.50	50.18	95.88	0.57	----	----	29.49	----	----	----	30.05
0.98	19.30	50.16	95.61	0.56	----	----	28.60	----	----	----	29.17

Continues on next page...

Hydrograph Report

Page 1

English

Hyd. No. 31

10 YR POST DEV ROUTED

Hydrograph type = Reservoir
Storm frequency = 10 yrs
Inflow hyd. No. = 11
Max. Elevation = 50.69 ft

Peak discharge = 60.02 cfs
Time interval = 1 min
Reservoir name = REVISED E&S PON
Max. Storage = 112,685 cuft

Storage Indication method used.

Total Volume = 179,011 cuft

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Outflow cfs
0.35	71.07	49.64	89.67	0.47	----	----	6.46	----	----	----	6.93
0.37	74.45	49.76	91.10	0.50	----	----	10.56	----	----	----	11.06
0.38	77.83	49.88	92.49	0.52	----	----	15.21	----	----	----	15.72
0.40	81.22	49.99	92.82	0.54	----	----	20.25	----	----	----	20.79
0.42	84.60 <<	50.10	94.62	0.55	----	----	25.33	----	----	----	25.88
0.43	82.91	50.20	96.14	0.57	----	----	30.36	----	----	----	30.93
0.45	81.22	50.29	97.11	0.58	----	----	35.06	----	----	----	35.64
0.47	79.53	50.36	97.95	0.59	----	----	39.34	----	----	----	39.93
0.48	77.83	50.43	98.67	0.60	----	----	43.15	----	----	----	43.75
0.50	76.14	50.48	99.28	0.61	----	----	46.50	----	----	----	47.12
0.52	74.45	50.53	99.79	0.62	----	----	49.43	----	----	----	50.05
0.53	72.76	50.57	100.22	0.62	----	----	51.90	----	----	----	52.53
0.55	71.07	50.60	100.57	0.63	----	----	53.95	----	----	----	54.58
0.57	69.37	50.63	100.85	0.63	----	----	55.66	----	----	----	56.29
0.58	67.68	50.65	101.07	0.64	----	----	56.99	----	----	----	57.63
0.60	65.99	50.67	101.24	0.64	----	----	58.00	----	----	----	58.64
0.62	64.30	50.68	101.35	0.64	----	----	58.71	----	----	----	59.35
0.63	62.60	50.68	101.43	0.64	----	----	59.16	----	----	----	59.80
0.65	60.91	50.69	101.46	0.64	----	----	59.37	----	----	----	60.01
0.67	59.22	50.69 <<	101.46	0.64	----	----	59.38	----	----	----	60.02 <<
0.68	57.53	50.69	101.43	0.64	----	----	59.20	----	----	----	59.84
0.70	55.84	50.68	101.38	0.64	----	----	58.85	----	----	----	59.49
0.72	54.14	50.67	101.30	0.64	----	----	58.36	----	----	----	59.00
0.73	52.45	50.66	101.19	0.64	----	----	57.74	----	----	----	58.38
0.75	50.76	50.65	101.07	0.64	----	----	57.00	----	----	----	57.64
0.77	49.07	50.64	100.93	0.63	----	----	56.16	----	----	----	56.79
0.78	47.38	50.62	100.78	0.63	----	----	55.22	----	----	----	55.85
0.80	45.68	50.61	100.61	0.63	----	----	54.21	----	----	----	54.84
0.82	43.99	50.59	100.43	0.63	----	----	53.14	----	----	----	53.76
0.83	42.30	50.57	100.24	0.62	----	----	52.02	----	----	----	52.64
0.85	40.61	50.55	100.04	0.62	----	----	50.84	----	----	----	51.46
0.87	38.92	50.53	99.82	0.62	----	----	49.61	----	----	----	50.23
0.88	37.22	50.51	99.60	0.62	----	----	48.34	----	----	----	48.95
0.90	35.53	50.49	99.37	0.61	----	----	47.03	----	----	----	47.64
0.92	33.84	50.47	99.14	0.61	----	----	45.72	----	----	----	46.33
0.93	32.15	50.45	98.89	0.61	----	----	44.38	----	----	----	44.98

Continues on next page...

Hydrograph Report

Page 1

English

Hyd. No. 32

25 YR POST DEV ROUTED

Hydrograph type = Reservoir
Storm frequency = 25 yrs
Inflow hyd. No. = 12
Max. Elevation = 50.86 ft

Peak discharge = 71.73 cfs
Time interval = 1 min
Reservoir name = REVISED E&S PON
Max. Storage = 118,487 cuft

Storage Indication method used.

Total Volume = 208,300 cuft

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Outflow cfs
0.33	78.10	49.70	90.39	0.48	----	----	8.37	----	----	----	8.85
0.35	82.01	49.83	91.92	0.51	----	----	13.22	----	----	----	13.72
0.37	85.91	49.96	92.79	0.53	----	----	18.60	----	----	----	19.13
0.38	89.82	50.08	94.19	0.55	----	----	24.19	----	----	----	24.74
0.40	93.72	50.19	96.02	0.57	----	----	29.95	----	----	----	30.52
0.42	97.63 <<	50.30	97.29	0.58	----	----	35.91	----	----	----	36.50
0.43	95.67	50.40	98.41	0.60	----	----	41.73	----	----	----	42.33
0.45	93.72	50.49	99.37	0.61	----	----	47.02	----	----	----	47.63
0.47	91.77	50.57	100.19	0.62	----	----	51.74	----	----	----	52.37
0.48	89.82	50.63	100.89	0.63	----	----	55.86	----	----	----	56.49
0.50	87.86	50.69	101.47	0.64	----	----	59.39	----	----	----	60.03
0.52	85.91	50.73	101.94	0.65	----	----	62.40	----	----	----	63.04
0.53	83.96	50.77	102.33	0.65	----	----	64.87	----	----	----	65.52
0.55	82.01	50.80	102.64	0.66	----	----	66.84	----	----	----	67.50
0.57	80.05	50.82	102.88	0.66	----	----	68.42	----	----	----	69.08
0.58	78.10	50.84	103.05	0.66	----	----	69.59	----	----	----	70.25
0.60	76.15	50.85	103.17	0.66	----	----	70.39	----	----	----	71.05
0.62	74.20	50.86	103.24	0.66	----	----	70.87	----	----	----	71.53
0.63	72.24	50.86 <<	103.27	0.66	----	----	71.07	----	----	----	71.73 <<
0.65	70.29	50.86	103.26	0.66	----	----	71.01	----	----	----	71.68
0.67	68.34	50.86	103.22	0.66	----	----	70.74	----	----	----	71.40
0.68	66.39	50.85	103.15	0.66	----	----	70.27	----	----	----	70.93
0.70	64.43	50.84	103.06	0.66	----	----	69.62	----	----	----	70.28
0.72	62.48	50.83	102.94	0.66	----	----	68.83	----	----	----	69.49
0.73	60.53	50.82	102.80	0.66	----	----	67.90	----	----	----	68.55
0.75	58.58	50.80	102.64	0.66	----	----	66.85	----	----	----	67.50
0.77	56.62	50.78	102.46	0.65	----	----	65.73	----	----	----	66.38
0.78	54.67	50.77	102.27	0.65	----	----	64.51	----	----	----	65.17
0.80	52.72	50.75	102.07	0.65	----	----	63.22	----	----	----	63.87
0.82	50.77	50.73	101.86	0.65	----	----	61.85	----	----	----	62.49
0.83	48.81	50.70	101.63	0.64	----	----	60.41	----	----	----	61.06
0.85	46.86	50.68	101.39	0.64	----	----	58.96	----	----	----	59.60
0.87	44.91	50.66	101.15	0.64	----	----	57.47	----	----	----	58.10
0.88	42.96	50.63	100.89	0.63	----	----	55.92	----	----	----	56.55
0.90	41.00	50.61	100.63	0.63	----	----	54.33	----	----	----	54.96
0.92	39.05	50.58	100.36	0.63	----	----	52.74	----	----	----	53.36

Continues on next page...

Hydrograph Report

Page 1

English

Hyd. No. 33

100 YR POST DEV ROUTED

Hydrograph type = Reservoir
Storm frequency = 100 yrs
Inflow hyd. No. = 13
Max. Elevation = 51.11 ft

Peak discharge = 90.02 cfs
Time interval = 1 min
Reservoir name = REVISED E&S PON
Max. Storage = 127,246 cuft

Storage Indication method used.

Total Volume = 254,703 cuft

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Outflow cfs
0.32	89.88	49.82	91.83	0.51	----	----	12.90	----	----	----	13.41
0.33	94.61	49.96	92.80	0.53	----	----	18.96	----	----	----	19.49
0.35	99.34	50.10	94.59	0.55	----	----	25.26	----	----	----	25.82
0.37	104.07	50.23	96.47	0.57	----	----	31.94	----	----	----	32.51
0.38	108.80	50.35	97.86	0.59	----	----	38.88	----	----	----	39.47
0.40	113.53	50.48	99.19	0.61	----	----	46.00	----	----	----	46.61
0.42	118.26 <<	50.59	100.45	0.63	----	----	53.22	----	----	----	53.85
0.43	115.89	50.70	101.58	0.64	----	----	60.10	----	----	----	60.75
0.45	113.53	50.79	102.54	0.65	----	----	66.20	----	----	----	66.85
0.47	111.16	50.87	103.33	0.66	----	----	71.48	----	----	----	72.15
0.48	108.80	50.93	103.99	0.67	----	----	75.96	----	----	----	76.63
0.50	106.43	50.98	104.53	0.67	----	----	79.69	----	----	----	80.35
0.52	104.07	51.02	104.94	0.65	----	----	82.63	----	----	----	83.29
0.53	101.70	51.05	105.26	0.64	----	----	84.92	----	----	----	85.56
0.55	99.34	51.08	105.50	0.62	----	----	86.67	----	----	----	87.30
0.57	96.97	51.10	105.68	0.61	----	----	87.94	----	----	----	88.56
0.58	94.61	51.11	105.79	0.60	----	----	88.80	----	----	----	89.41
0.60	92.24	51.11	105.86	0.60	----	----	89.28	----	----	----	89.88
0.62	89.88	51.11 <<	105.88	0.60	----	----	89.43	----	----	----	90.02 <<
0.63	87.51	51.11	105.85	0.60	----	----	89.27	----	----	----	89.87
0.65	85.15	51.11	105.80	0.60	----	----	88.84	----	----	----	89.45
0.67	82.78	51.10	105.71	0.61	----	----	88.19	----	----	----	88.80
0.68	80.42	51.09	105.59	0.62	----	----	87.34	----	----	----	87.96
0.70	78.05	51.07	105.45	0.63	----	----	86.32	----	----	----	86.95
0.72	75.69	51.06	105.29	0.63	----	----	85.14	----	----	----	85.78
0.73	73.32	51.04	105.11	0.65	----	----	83.83	----	----	----	84.47
0.75	70.96	51.02	104.91	0.66	----	----	82.38	----	----	----	83.04
0.77	68.59	51.00	104.69	0.67	----	----	80.83	----	----	----	81.50
0.78	66.22	50.97	104.45	0.67	----	----	79.14	----	----	----	79.80
0.80	63.86	50.95	104.19	0.67	----	----	77.36	----	----	----	78.03
0.82	61.49	50.92	103.93	0.67	----	----	75.52	----	----	----	76.18
0.83	59.13	50.90	103.65	0.67	----	----	73.61	----	----	----	74.28
0.85	56.76	50.87	103.37	0.66	----	----	71.71	----	----	----	72.37
0.87	54.40	50.84	103.07	0.66	----	----	69.75	----	----	----	70.41
0.88	52.03	50.81	102.77	0.66	----	----	67.74	----	----	----	68.40
0.90	49.67	50.78	102.46	0.65	----	----	65.73	----	----	----	66.39

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DRAINAGE CALCULATIONS

FOR

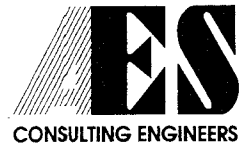
WILLIAMSBURG PLANTATION SECTION 5: UNITS 97-133

Longhill Road
Williamsburg, Virginia 23188

SEP 10 2000

Prepared By:

AES Consulting Engineers
5248 Olde Towne Road, Suite 1
Williamsburg, Virginia 23188
AES Project No. 7555-12
August 23, 2000
Revised: March 21, 2001



NARRATIVE

This project encompasses the construction of roadway, water and sanitary utilities, and storm water drainage associated with the development of thirty-seven timeshare units in the Williamsburg Plantation, James City County, Virginia. Additionally, this project includes construction of modifications to an existing stormwater management/ best maintenance practice known as VDOT Facility "G". The modifications were previously approved by the Environmental Division on 12/30/99.

The project area presently contains a temporary sediment basin to serve the Clubhouse facility. This basin will be utilized to begin construction of Phase I of the project (See sheet 3a). Upon completion of VDOT Facility "G" the temporary sediment basin is to be closed and the existing storm system from the Clubhouse extended through the project area. VDOT Facility "G" shall serve as the temporary sediment basin for Section 5 (Phase II) during construction activities. Following construction, Facility "G" shall continue to function as a SWM/ BMP extended detention dry pond.

The storm system proposed with Section 5 is the trunk line for the remainder of the development draining toward Facility "G". Thus, the system has been designed for the future drainage contribution of the remainder of the Williamsburg Plantation project draining through the system. Additional Sections shall be connected to the trunk line at structure #7.

Table 2

Worksheet for BMP Point System

A. STRUCTURAL BMP POINT ALLOCATION

<u>BMP</u>	<u>BMP Points</u>		<u>Fraction of Site Served by BMP</u>		<u>Weighted BMP Points</u>
<u>EX. WET POND</u>	<u>10</u>	x	<u>$\frac{27.25+6.72}{75.65}$</u>	=	<u>4.49</u>
<u>DRY POND</u>	<u>9</u>	x	<u>$\frac{19.66+27.34}{75.65}$</u>	=	<u>5.59</u>
<u>(w/ VDOT)</u>		x		=	
<u>DRY POND</u>	<u>4</u>	x	<u>$\frac{19.03}{75.65}$</u>	=	<u>1.01</u>

TOTAL WEIGHTED STRUCTURAL BMP POINTS: 11.09

B. NATURAL OPEN SPACE CREDIT

<u>Fraction of Site</u>		<u>Natural Open Space Credit</u>		<u>Points for Natural Open Space</u>
<u>$\frac{14.5}{75.65}$</u>	x	<u>0.1</u>	=	<u>1.92</u>
		(0.1 per 1%)		
	x		=	
		(0.15 per 1%)		

TOTAL NATURAL OPEN SPACE CREDIT: 1.92

C. TOTAL WEIGHTED POINTS

<u>11.09</u>	+	<u>1.92</u>	=	<u>13.01</u>
Structural BMP Points		Natural Open Space Points		Total

* SEE ATTACHED NOTES

BMP Point Tabulation for Williamsburg Plantation
3/22/00

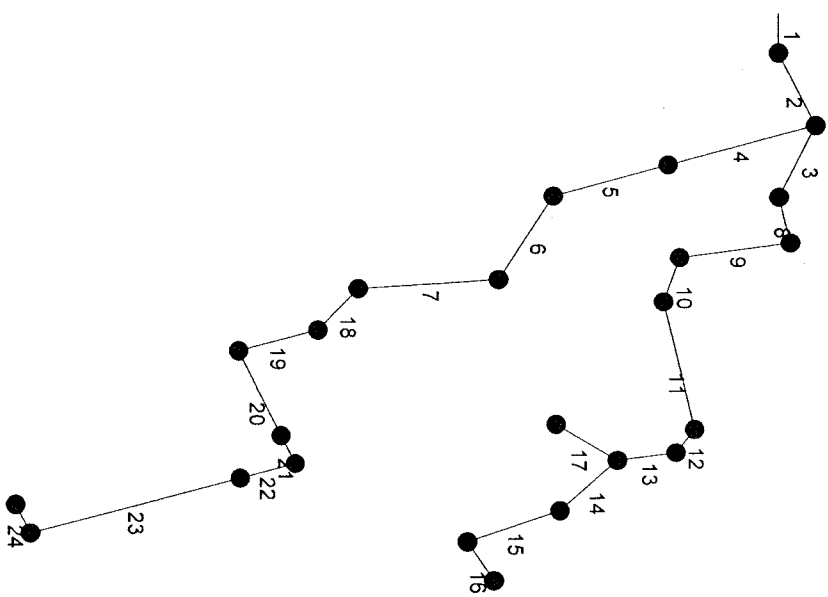
Notes:

1. The total site area of Williamsburg Plantation is 75.65 AC following the condemnation of 1.43 AC by VDOT for the construction of Route 199.
2. During the development of Regency at Longhill II, adjacent to Williamsburg Plantation, the existing wet pond was enlarged and redesigned to accommodate additional flow from Regency. The total drainage area to the 10 point wet pond is 33.97 AC (as approved with the Regency development), of which 27.25 AC is on-site and 6.72 is off-site contribution.
3. The dry pond shared with VDOT was redesigned (and approved) in the spring of 1999 to provide water quality and attenuation for both the VDOT and Plantation drainage areas. The total drainage area to this 9-point facility is 47 AC, of which 19.66 is on-site and 27.34 is off-site contribution.
4. The open space quantity has been revised to reflect the 1.43 AC loss. Additionally, the 0.5 AC area just north of Section 3 has been removed from the open space number. This area contains many dead trees and bushes. The developer wishes to landscape it during a future submittal. The revised open space number is 14.5 AC.
5. The future BMP is to be a dry pond. Conservatively, this pond is estimated at 4 points.

STORM SYSTEM CALCULATIONS

Hydraflow Plan View

WILLAMSBURG PLANTATION
SECTION 5 DRAINAGE CALCULATIONS
INCLUDES ROAD EXTENSION
AND FUTURE DEVELOPMENT



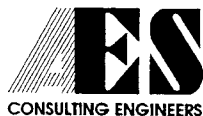
Hydraflow Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (l)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID	
Line	To Line		Incr	Total		Incr	Total	Inlet	Syst					Size	Slope	Up	Dn	Up	Dn	Up	Dn		
1	End	55.0	0.43	9.48	0.50	0.22	6.09	10.0	17.0	4.9	43.19	60.58	8.80	30	2.18	48.50	47.30	51.82	51.21	53.50	49.80	2-1	
2	1	107.0	1.15	9.05	0.75	0.86	5.87	10.0	16.4	5.0	42.60	108.6	9.01	30	7.01	56.00	48.50	58.19	52.36	63.00	53.50	3-2	
3	2	106.0	0.00	4.86	0.00	0.00	2.93	0.0	14.3	5.2	15.37	21.97	4.89	24	0.94	57.00	56.00	60.04	59.55	65.30	63.00	3A-3	
4	2	157.0	0.31	3.04	0.75	0.23	2.08	5.0	15.5	5.1	24.06	34.49	7.97	24	2.32	59.65	56.00	61.39	59.55	68.70	63.00	4 - 3	
5	4	123.0	0.48	2.73	0.75	0.36	1.85	5.0	14.8	5.2	23.06	43.26	7.76	24	3.66	64.15	59.65	66.86	61.55	74.05	68.70	5 - 4	
6	5	128.0	0.35	2.25	0.75	0.26	1.49	5.0	14.1	5.3	21.35	46.46	7.28	24	4.22	69.55	64.15	71.19	66.62	80.40	74.05	6-5	
7	6	138.0	0.31	1.90	0.55	0.17	1.23	10.0	13.3	5.4	20.11	35.76	6.96	24	2.50	73.00	69.55	74.59	71.98	80.00	80.40	7 - 6	
8	3	65.0	1.67	4.86	0.55	0.92	2.93	10.0	13.9	5.3	15.53	44.36	5.79	24	3.85	59.50	57.00	60.90	60.20	63.00	65.30	3B-3A	
9	8	113.0	0.73	3.19	0.50	0.37	2.01	10.0	13.3	5.4	10.85	20.96	6.50	18	3.98	64.00	59.50	65.26	61.58	68.00	63.00	3C-3B	
10	9	63.0	0.00	2.46	0.00	0.00	1.64	0.0	12.9	5.5	8.97	34.65	5.64	18	10.89	70.86	64.00	72.00	65.88	74.50	68.00	3D-3C	
11	10	179.0	0.18	2.46	0.90	0.16	1.64	5.0	11.9	5.6	9.24	15.54	5.83	18	2.19	74.78	70.86	75.94	72.27	79.79	74.50	4D-3D	
12	11	38.0	0.51	2.28	0.75	0.38	1.48	5.0	11.7	5.7	8.38	6.95	6.83	15	1.16	75.22	74.78	77.04	76.40	79.98	79.79	4E-4D	
13	12	60.0	0.32	1.77	0.70	0.22	1.10	5.0	11.4	5.7	6.28	7.36	5.12	15	1.30	76.00	75.22	78.16	77.59	82.84	79.98	4F-4E	
14	13	90.0	0.27	0.99	0.60	0.16	0.53	5.0	10.9	5.8	3.08	17.35	3.42	15	7.22	82.50	76.00	83.20	78.46	86.50	82.84	4G-4F	
15	14	100.0	0.18	0.72	0.40	0.07	0.37	5.0	10.3	5.9	2.18	6.46	3.16	15	1.00	83.50	82.50	84.09	83.33	87.50	86.50	4H-4G	
16	15	60.0	0.54	0.54	0.55	0.30	0.30	10.0	10.0	6.0	1.77	4.57	2.62	15	0.50	83.80	83.50	84.38	84.32	87.50	87.50	4I-4H	
17	13	80.0	0.46	0.46	0.75	0.34	0.34	5.0	5.0	7.1	2.46	10.21	2.99	15	2.50	78.00	76.00	78.63	78.46	81.67	82.84	4F1-4F	
18	7	70.0	0.06	1.59	0.65	0.04	1.06	5.0	13.0	5.5	19.26	38.23	9.52	24	2.86	79.00	77.00	80.58	78.03	83.50	80.00	10-7	
19	18	85.0	0.00	1.53	0.00	0.00	1.02	0.0	12.5	5.5	19.12	25.73	6.71	24	1.29	80.10	79.00	81.65	81.19	87.00	83.50	11-10	
20	19	124.0	0.18	1.53	0.90	0.16	1.02	5.0	11.8	5.6	13.24	23.16	4.97	24	1.05	81.40	80.10	82.78	82.48	88.92	87.00	12-11	
21	20	42.0	0.09	1.35	0.60	0.05	0.86	5.0	11.6	5.7	12.36	24.68	5.53	24	1.19	81.90	81.40	83.15	82.85	88.92	88.92	13-12	
Project File: 755514sys1-32101.slm								I-D-F File: JCCStomsewer.IDF								Total number of lines: 24				Run Date: 03-21-2001			
NOTES: Intensity = 143.72 / (Tc + 19.20) ^ 0.94; Return period = 10 Yrs.; Initial tailwater elevation = 51.21 (ft)																							

Hydraflow Storm Sewer Tabulation

Station		Len	Drng Area		Rhoft coeff	Area x C		Tc		Rain (l)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rlm Elev		Line ID
Line	To Line		Incr	Total		Incr	Total	Inlet	Syst					Size	Slope	Up	Dn	Up	Dn	Up	Dn	
		(ft)	(ac)	(ac)	(C)			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
22	21	59.0	0.35	1.26	0.61	0.21	0.80	10.0	11.2	5.7	12.10	22.81	5.01	24	1.02	82.50	81.90	83.73	83.71	90.16	88.92	14-13
23	22	222.0	0.68	0.91	0.56	0.38	0.59	10.0	10.0	6.0	3.51	8.99	3.71	15	1.94	86.80	82.50	87.55	83.81	94.14	90.16	15-14
24	23	42.0	0.23	0.23	0.90	0.21	0.21	5.0	5.0	7.1	1.47	15.75	2.33	15	5.95	89.30	86.80	89.79	87.87	94.14	94.14	16-15
Project File: 756514sys1-32101.stm																						
I-D-F File: JCCstormsewer.IDF																						
Total number of lines: 24																						
Run Date: 03-21-2001																						
NOTES: Intensity = 143.72 / (Tc + 19.20) ^ 0.94; Return period = 10 Yrs. ; Initial tailwater elevation = 51.21 (ft)																						

SPREAD CALCULATIONS



5248 Olde Towne Road, Suite 1
Williamsburg, Virginia 23188
(757) 253-0040
Fax: (757) 220-8994

PROJECT WMERG PLNT JEC 5

PROJECT NO. 7555-12

SUBJECT SPREAD CALCS

SHEET NO. 1 OF 2

CALCULATED BY DPW DATE 7/28/00

ALL SUMP LOCATIONS

SS#3

$$DA = 0.36 AC$$

$$C = 0.75$$

$$i_{10} = 4 \text{ in./hr. BIVDOT}$$

$$Q_{10} = 1.08 \text{ CFS}$$

$$DI-3A \quad L = 2.5'$$

$$P_{EFF} = L + 1.8W = 2.5 + 1.8(2) = 6.1'$$

$$\text{depth @ inlet, } d = 0.17' < 6'' \text{ OK}$$

$$\text{spread, } T = d / \frac{i_{10}}{54} = \frac{0.17}{0.02} = 8.5' \text{ OK}$$

SS#3 → DI-3A

SS#4

$$DA = 0.48 AC$$

$$C = 0.75$$

$$i_{10} = 4 \text{ in./hr.}$$

$$Q_{10} = 1.44 \text{ CFS}$$

$$DI-3B, L = 4'$$

$$P_{EFF} = 7.6'$$

$$d = 0.18' < 6'' \text{ OK}$$

$$T = 0.18 / 0.016 = 11.3' \text{ OK B/C @ DUMPSTER}$$

SS#5

$$DA = 0.34 AC$$

$$C = 0.75$$

$$i_{10} = 4 \text{ in./hr.}$$

$$Q_{10} = 1.02 \text{ CFS}$$

$$DI-3A$$

$$P_{EFF} = 6.1'$$

$$d = 0.16' \text{ OK}$$

$$T = 0.16 / 0.018 = 8.9' \text{ OK}$$

SS#5 → DI-3A

SS#6

$$DA = 0.54 AC$$

$$C = 0.75$$

$$i_{10} = 4 \text{ in./hr.}$$

$$Q_{10} = 1.62$$

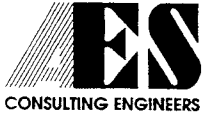
$$DI-3B, L = 6'$$

$$P_{EFF} = 9.6'$$

$$d = 0.17' \text{ OK}$$

$$T = 0.17 / 0.017 = 10.0' \text{ OK}$$

SS#6 → DI-3B, L=6'



5248 Olde Towne Road, Suite 1
Williamsburg, Virginia 23188
(757) 253-0040
Fax: (757) 220-8994

PROJECT WIMBERG PLANT SEC 5
PROJECT NO. 1555-12
SUBJECT SPREAD PILES
SHEET NO. 2 OF 2
CALCULATED BY LHW DATE 7/28/00

ALL SUMP VENTILATIONS

SS# 7A

$$DA = 0.40 \text{ AC}$$

$$C = 0.1$$

$$i_{10} = 4 \text{ in / hr}$$

$$Q_{10} = 1.12 \text{ CFS}$$

DI-3A

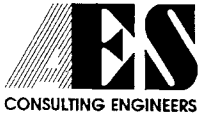
$$P_{EFF} = 6.1'$$

$$d = 0.17' \text{ OK}$$

$$T = 0.11 / 0.043 = 3.95' \text{ OK}$$

SS# 7A → DI-3A

**TEMPORARY SEDIMENT
BASIN CALCULATIONS**



5248 Olde Towne Road, Suite 1
Williamsburg, Virginia 23188
(757) 253-0040
Fax: (757) 220-8994

PROJECT WMBG PLANT. SECT 5
PROJECT NO. 7555-12
SUBJECT TEMP. SEDIMENT BASIN
SHEET NO. 1 OF
CALCULATED BY DPW DATE 8/7/00

EXISTING SWM/BMP FACILITY IS TO BE MODIFIED AS PART OF THIS PROJECT. FACILITY WILL SERVE AS EROSION AND SEDIMENT CONTROL BASIN DURING CONSTRUCTION ACTIVITIES.

PROJECT AREA = 6.0 AC \pm

ADDITIONAL RECREATION CENTER AREA = 2.0 AC \pm

\therefore TOTAL DA = 8.0 AC \pm

→ 134 CY/AC RQD FOR TEMP BASIN - $\frac{1}{2}$ WET AND $\frac{1}{2}$ DRY

134 CY/AC (8.0 AC) = 1,072 CY = 28,944 CF

WET RQD = 14,472 CF = DRY RQD

→ USING APPROVED CALCULATIONS FOR FACILITY MODIFICATIONS:

27,056 CF AVAILABLE @ EL 48.0 → DEWATERING ORIFICE (1)

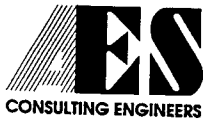
27,056 CF > 14,472 CF \therefore OK

59,620 CF AVAILABLE B/W EL 48 & 50 - DEWATERING

59,620 CF > 14,472 CF \therefore OK

ORIFICE (2)

FACILITY WILL FUNCTION AS
TEMPORARY CONSTRUCTION BASIN



5248 Olde Towne Road, Suite 1
Williamsburg, Virginia 23188
(757) 253-0040
Fax: (757) 220-8994
E-Mail: aes@aesva.com

PROJECT WILLIAMSBURG PLANTATION, SEC. 5
PROJECT NO. 7555-12
SUBJECT OUTLET PROTECTION DESIGN
SHEET NO. 1 OF 1
CALCULATED BY CBR DATE 10/17/00

$$Q_{10} = 42.2 \text{ CFS}$$

* ASSUME MAXIMUM TAILWATER CONDITION

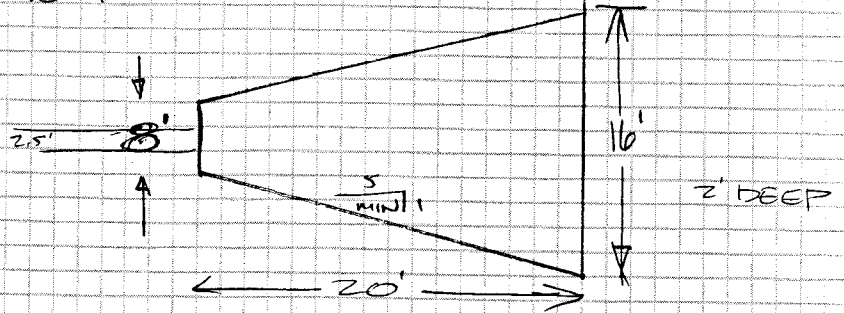
FROM VESCH PLATE 3.18-4

$$d_o = 25'$$

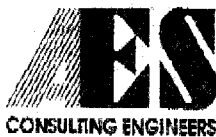
$$L_a = 22'$$

$$\begin{aligned} W &= D_o + 0.4 L_a \\ &= 25' + 0.4(22') \\ &= 11.3 \approx 12' \end{aligned}$$

$$d_{50} = 6''$$



CONTRACTOR SHALL PROVIDE CLASS I RIP RAP APRON
W/FILTER FABRIC, IN ACCORDANCE W/ THE VESCH.
APRON SHALL BE ^{20' LONG X 2' DEEP X} 12' WIDE AT PIPE OUTLET AND 16' WIDE AT
DOWNSTREAM END. (APPROX. 18 CY)



AES Consulting Engineers Fax Memorandum

5258 Olde Towne Road, Suite 1 • Williamsburg, Virginia 23188
 Telephone: (757) 253-0040 • Facsimile: (757) 220-8994 • Email: aes@aesva.com

To: Mr. Darryl Cook	Org./Firm: JCC Environmental Division
Fax Number: 259-4032	Date: 3/13/01
From: Charles Records <i>CR</i>	Pages Including Cover Page: 2
cc:	cc Fax Number:
Subject: Williamsburg Plantation – VDOT Facility “G”	

☒ Urgent ☐ For Review ☐ Please Comment ☒ Please Reply

Comments:

Darryl,

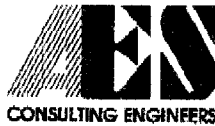
Attached is a copy of Telephone Correspondence with Mr. John Dewell of VDOT. I wanted to make sure you understood the agreements Williamsburg Plantation has made with VDOT. The last iteration of the pond's design has resulted in VDOT allowing the use of the SCS method. John Dewell asked that we further increase the elevations on the emergency spillway and top of dam. I hope this will satisfy your concerns about the use of the SCS method. Additionally, as we discussed and you approved last month, we have eliminated the shallow marsh due to VDOT concerns.

We anticipate sending plans over to your office this Friday with the Overall and Erosion and Sediment Control revisions included. If you have any questions, feel free to give me a call.

Thanks.

Charles Records

Confidentiality Note: The documents accompanying this fax may contain confidential information. This information is intended only for the use of the individual or entity named on the transmission sheet. If you are not the intended recipient, you are hereby notified that any disclosure, copying, distribution, or the taking of any action in reliance on the contents of this faxed information is strictly prohibited, and that the documents should be returned to AES Consulting Engineers. If you have received this fax in error, please notify us by telephone immediately at the number above so that we can arrange for the return of the original document at no cost to you.



Telephone/Visit Correspondence Report

DATE: 3/12/01
PROJECT NAME: VDOT Facility "G"
PROJECT NO: 7555-6
CLIENT: Williamsburg Plantation
PERSON/TITLE:
TALKED WITH: Mr. John Dewell
 Senior Hydraulic Engineer
 (F) 004 225 3686

SUMMARY OF CONVERSATION:

decrease emergency width

Mr. Dewell was responding to revised drainage calculations by AES for VDOT Facility "G" treating drainage from both Williamsburg Plantation and Route 199. Mr. Dewell identified that in comparing the AES and VDOT calculations for the pond, that the VDOT calculations were slightly more conservative. He requested and AES agreed that modifications be made to increase the elevations of the emergency spillway (from 51.25 to 52.0) and width (from 30' to 20') and the top of dam (from 53.0 to 54.0). Mr. Dewell stated that the pond footprint was to remain the same as shown on the approved plans dated 9-28-99 and the existing principal spillway would not require modifications. Mr. Records asked if the existing 4" orifice could be used to dewater the temporary sediment basin, resulting in a longer dewatering time (32 hr), and Mr. Dewell agreed with using the existing 4" orifice.

CONCLUSION/ACTION:

Per our conversation summarized above, the final construction documents for this facility are being prepared. Mr. Dewell does not require a set(s) of plans and they only need to be submitted to Mr. P.K. Das, Williamsburg Residency.

SPECIAL INSTRUCTIONS:

CC: DARRYL COOL, 259 4032
 P.K. DAS, 253-5148

☐ We Phoned ☒ They Phoned

☐ We Visited ☐ They Visited

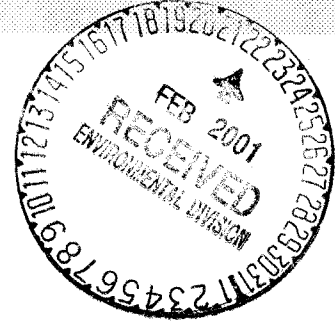
SUBJECT AREA:

AES REPRESENTATIVE(S):

Charles Records *CR*

The Bush Companies
The Plantation Group, LLC
4029 Ironbound Road
Suite 200
Williamsburg, VA 23188
Tel 757/220-2874 Fax 757/229-2542

transmittal



To: DARRYL COOK

JAMES CITY COUNTY

ENVIRONMENTAL DIVISION

From:	KEN YERBY, CCM	Date:	02/22/01
Re:	WILLIAMSBURG PLANTATION	Pages:	9
	SECTION 5 SITEWORK UNITS 97-133	Job:	480
	VDOT EXTRA		

<input type="checkbox"/> Urgent	<input type="checkbox"/> For Review	<input type="checkbox"/> For Approval	<input type="checkbox"/> Please Reply	<input type="checkbox"/> For Your Use
---------------------------------	-------------------------------------	---------------------------------------	---------------------------------------	---------------------------------------

- FES EXISTING EARTHEN DAM EVALUATION REPORT DATED 2/21/2001

CC: RW/FILE



FOUNDATION ENGINEERING SCIENCE, INC.

- Geotechnical Engineering [Drilling; Foundation, Retaining Wall & Pavement Design]
- Environmental Management [Phase I & II, Asbestos and Lead Paint Samplings]
- Construction Materials Testing & Inspection [Quality Control & Quality Assurance]
- Foundation Settlement & Pavement Evaluations
- Value Engineering During Design & Construction

Mr. Ken Yerby
C/O Williamsburg Plantation, Inc.
4029 Ironbound Road, Suite 200
Williamsburg, Virginia 23188

February 21, 2000

Re: Existing Earthen Dam Evaluation Report
Williamsburg Plantation, Phase 5
James City County, Virginia
FES Project No. 1-9C120.115

Dear Mr. Yerby:

Pursuant to your request and verbal authorization, an experienced project engineer with Foundation Engineering Science, Inc. (FES) visited the project site on February 19, 2001. The specific purpose of this visit was to perform auger borings within the existing earthen dam located at Williamsburg Plantation, Phase 5 in James City County, Virginia.

1.0 SITE OBSERVATIONS AND FIELD EXPLORATION

During our site observation, four (4) auger borings were performed within the existing earthen dam. The auger borings were performed to depths ranging from six (6) to seven and one half (7.5) feet below the existing grades [from the crest of the earthen dam].

AB 2, 3, 4 were
TAKEN @ THE TOE.

The soil conditions encountered at the auger borings tabulated below

LOCATIONS	SOIL LAYER	SOIL DESCRIPTION	DEPTH RANGE (FEET)	UNIFIED SYMBOL
AB-1	1	Brown, silty sand with trace clay "TOPSOIL"	0 - 0.5	SM
	2	Brown, moist silty SAND with trace clay	0.5 - 3	SM
	3	Gray to brown silty SAND with trace organic matter at depth 5	3 - 6	SM
	4	Brown, moist silty SAND with trace clay	6 - 7.5	SM
AB-2	1	Brown silty SAND "TOPSOIL"	0 - 0.5	SM
	2	Light brown silty SAND with trace clay	0.5 - 3.0	SM
	3	Brown, saturated clayey SAND	3 - 6	SC
AB-3	1	Brown silty SAND with trace clay "TOPSOIL"	0 - 5	SM
	2	Brown silty SAND with trace clay	0.5 - 1.5	SM
	3	Gray to brown silty SAND	1.5 - 6	SM

LOCATIONS	SOIL LAYER	SOIL DESCRIPTION	DEPTH RANGE (FEET)	UNIFIED SYMBOL
AB-4	1	Brown silty SAND	0 - 0.5	SM
	2	Gray to brown, moist to saturated, silty SAND	0.5 - 6	SM

The ground water table was three (3) feet below existing ground in the auger boring AB-2, AB-3 and AB-4 and the water table was not encountered in the borings AB-1.

2.0 LABORATORY TESTING PROGRAM

The soil conditions encountered in the auger borings performed were arranged in three (3) to four (4) layer soils configurations. Additionally, the soils were classified by an experienced project engineer in general accordance with the Unified Soil Classification System (USCS) in general accordance with ASTM D-2487 and D-2488. The soils encountered in the borings performed were subjected to grain size determination [Passing No. 200 Sieve] and natural moisture content tests. The laboratory test results are tabulated below.

LOCATION	APPROX. SAMPLE DEPTH (Feet)	NATURAL MOIST CONTENT (%)	#200 SIEVE (%)	ATTERBERG LIMITS		USCS	OPT. MOIST. CONTENT (%)	MAX. DRY DENSITY (pcf)	CBR VALUE (%)
				LL (%)	PI (%)				
AB-1	1 - 3	14.7	35.5	---	---	SM	---	---	---
	3 - 4	14.2	38.5	---	---	SM	---	---	---
	4 - 5	13.8	34.7	---	---	SM	---	---	---
	5 - 6	14.5	41.5	---	---	SM	---	---	---
	6 - 7	19.7	37.2	---	---	SM	---	---	---
	7 - 7.5	20.0	40.0	---	---	SM	---	---	---
AB-2	0 - 1.5	19.2	32.4	---	---	SM	---	---	---
	1.5 - 3	18.6	24.2	---	---	SM	---	---	---
	3 - 5.5	23.6	39.5	---	---	SC	---	---	---
	5.5 - 6	46.7	49.2	---	---	SC	---	---	---
AB-3	0 - 1.5	20.1	36.7	---	---	SM	---	---	---
	1.5 - 4	17.4	28.4	---	---	SM	---	---	---
	4 - 6	15.4	41.9	---	---	SM	---	---	---
AB-4	0 - 1	23.0	37.3	---	---	SM	---	---	---
	1 - 2	19.0	36.7	---	---	SM	---	---	---
	2 - 4	19.4	22.7	---	---	SM	---	---	---
	4 - 6	12.9	33.1	---	---	SM	---	---	---


Based on the laboratory test results, the majority of the soils encountered in the auger borings consisted of cohesion-less silty sand (SM) and clayey sand (SC).

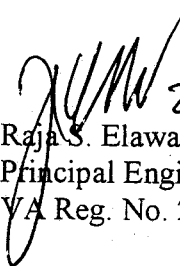
Existing Earthen Dam Evaluation Report
•Williamsburg Plantation, Section Five
James City County, Virginia
FES Report No. 1-9C120.115

FES appreciates the opportunity to be of service to **Williamsburg Plantation, Inc.** on this important project and looks forward to its successful completion. Should you have any questions regarding this report, please do not hesitate to contact the undersigned.

Respectfully submitted,

FOUNDATION ENGINEERING SCIENCE, INC.

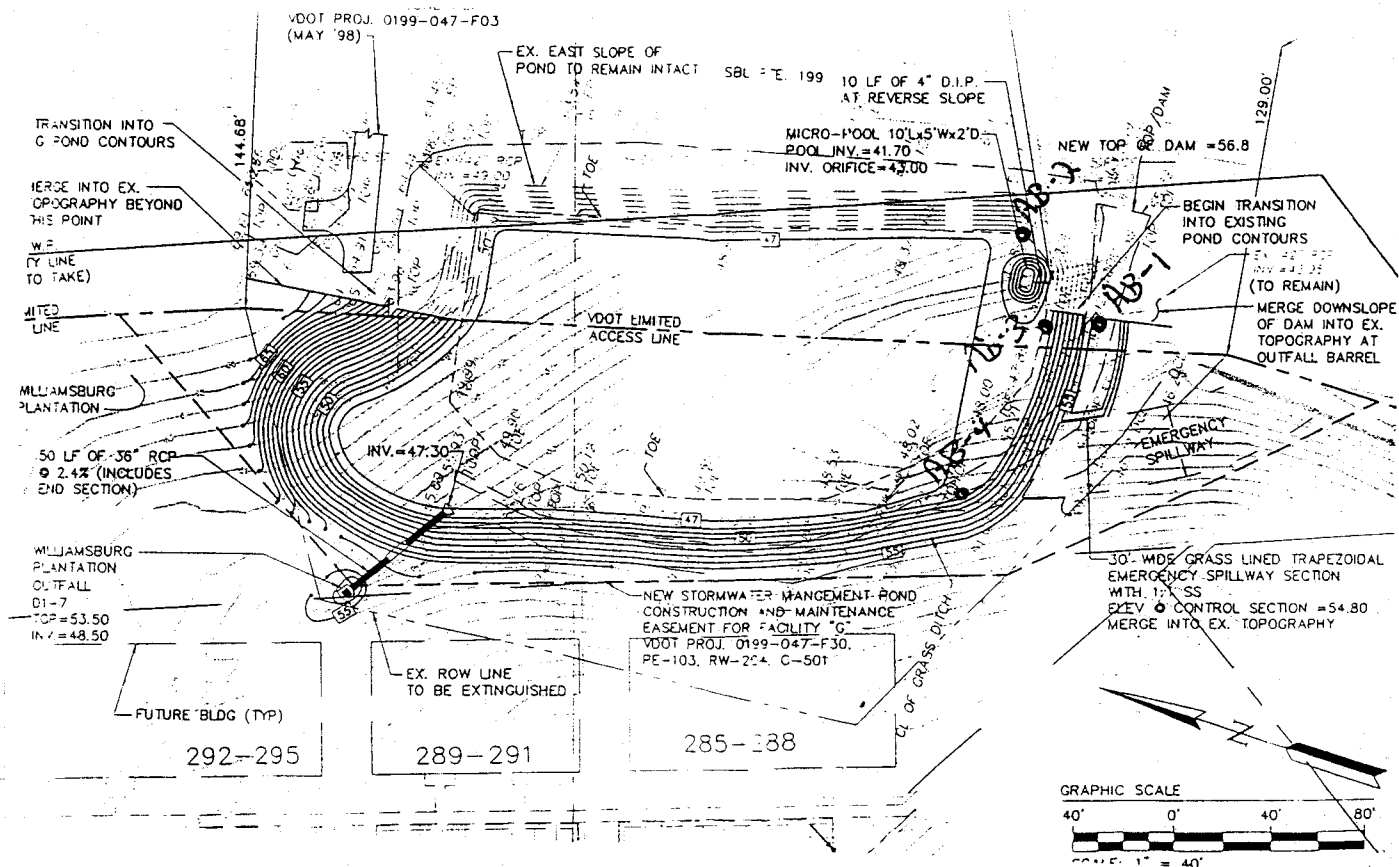

2/21/01
Idres Hawarry
Project Engineer


2/21/01
Raja S. Elawar, P.E.
Principal Engineer
VA Reg. No. 26383

Attachment: Figure 1 – Borings Location Sketch
Borings Profile Sheets

XCopies: (1) Client

C:\company\OLD Files\1999\1-9C120.115



FOUNDATION ENGINEERING SCIENCE, INC.
GEOTECHNICAL, ENVIRONMENTAL & CONSTRUCTION MATERIALS TESTING

11843-B CANON BOULEVARD
NEWPORT NEWS, VIRGINIA 23606
PHONE: 757-873-873-4113 FAX: 4114

DATE:
FEBRUARY 19, 2001

SCALE:
N/A

FES PROJECT NO.
1-9C120.115

CONSTRUCTION MATERIALS TESTING SERVICES
WILLIAMSBURG PLANTATIONS, SECTION 5
JAMES CITY COUNTY, VIRGINIA

FIGURE - 1
AUGER BORING LOCATION SKETCH

PROJECT NAME: Williamsburg Plantations Section Five

PROJECT NO.: 1-9C120

CLIENT: Williamsburg Plantation, Inc.

DRILLING METHOD: Hand Auger

PROJECT LOCATION: James City County, Virginia

OBSERVED G.W.T.: Not Encountered

BORING LOCATION: AB-4

STATION NO.:

[illegible]

COMPLETION DEPTH: 6.0 feet

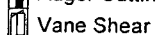
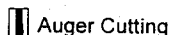
DATE BORING STARTED: 2/19/01

DATE BORING COMPLETED: 2/19/01

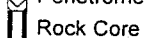
ENGINEER/GEOLOGIST: IH

DRILLING CONTRACTOR: FES

Sample Types:



UD



Remarks:

Unless otherwise noted, water encountered but not recorded.

The stratification lines represent approximate boundaries. The transition may be gradual.

**FOUNDATION ENGINEERING SCIENCE, INC.**

• Geotechnical Engineering
• Environmental Management
• Construction Materials Testing

11843-B Canon Boulevard
Newport News, Virginia 23606
Phone: 757-873-4113 Fax: 757-873-4114
Email: relawar@fesva.com

AB-1

Sheet 1 of 1

PROJECT NAME: Williamsburg Plantations Section Five

PROJECT NO.: 1-9C120

CLIENT: Williamsburg Plantation, Inc.

DRILLING METHOD: Hand Auger

PROJECT LOCATION: James City County, Virginia

OBSERVED G.W.T.: Not Encountered

BORING LOCATION: AB-1

STATION NO.:

ELEVATION (Feet)	DEPTH (Feet)	SOIL LEGEND & SAMPLE TYPES	SAMPLE NO.	SOIL CLASSIFICATION	MATERIAL DESCRIPTION	SPT N VALUE OR RQD %	STANDARD PENETRATION TEST N-VALUE (Blows/Ft)	HOLE COMPLETION & REMARKS
55.0	0			SM	Brown silty SAND with trace of clay "TOPSOIL"		1 10 20 30 50 80	
54.5				SM	Brown, moist silty SAND with trace clay			
52.0				SM	Gray to brown silty SAND with trace organic matter at depth 5			
50	5							
49.0				SM	Brown silty SAND with trace clay			

COMPLETION DEPTH: 8.0 feet

DATE BORING STARTED: 2/19/01

DATE BORING COMPLETED: 2/19/01

ENGINEER/GEOLOGIST: IH

DRILLING CONTRACTOR: FES

Sample Types:

Auger Cutting
 Vane Shear
 SPT

UD
 Penetrometer
 Rock Core

Remarks:

Unless otherwise noted, water encountered but not recorded.

The stratification lines represent approximate boundaries.
The transition may be gradual.

LOG OF BORING 1-9C120 GPJ FES GDT 2/21/01

**FOUNDATION ENGINEERING SCIENCE, INC.**

· Geotechnical Engineering
· Environmental Management
· Construction Materials Testing

11843-B Canon Boulevard
Newport News, Virginia 23606
Phone: 757-873-4113 Fax: 757-873-4114
Email: relawar@fesva.com

AB-3

Sheet 1 of 1

PROJECT NAME:	Williamsburg Plantations Section Five	PROJECT NO.:	1-9C120
CLIENT:	Williamsburg Plantation, Inc.	DRILLING METHOD:	Hand Auger
PROJECT LOCATION:	James City County, Virginia	OBSERVED G.W.T.:	Not Encountered
BORING LOCATION:	AB-3	STATION NO.:	

ELEVATION (Feet)	DEPTH (Feet)	SOIL LEGEND & SAMPLE TYPES	SAMPLE NO.	SOIL CLASSIFICATION	MATERIAL DESCRIPTION	SPT, N VALUE OR RQD %	STANDARD PENETRATION TEST N-VALUE (Blows/Ft)	HOLE COMPLETION & REMARKS
48.0	0			SM	Brown silty SAND with trace clay "TOPSOIL"		1 10 20 30 50 80	
47.5				SM	Brown silty SAND with trace CLay			
46.5				SM	Gray to brown silty SAND			
45								
5								

COMPLETION DEPTH: 6.0 feet

DATE BORING STARTED: 2/19/01

DATE BORING COMPLETED: 2/19/01

ENGINEER/GEOLOGIST: IH

DRILLING CONTRACTOR: FES

Sample Types:

Auger Cutting

Vane Shear

SPT

UD

Penetrometer

Rock Core

Remarks:

Unless otherwise noted, water encountered but not recorded.

The stratification lines represent approximate boundaries.
The transition may be gradual.

LOG OF BORING 1-9C120 GPJ FES GDT 2/21/01

WILL PLANTATION - FACILITY G

2/16/01

1. WQ Volume -

52,889 ft^3 - elev 48.9

$\frac{1}{2}$ volume prov. perm. pool - 48.0 or 27,056 ft^3

$\frac{1}{2}$ volume ED - 24,000 ft^3 - elev 48.9

Ex DI @ 49.3 - ok

24 hr release rate or use minimum 3"

2. 2 year control -

elev 52.89 18.5 cfs < 51.8 cfs reqd

3. 10 yr - needs to go thru prin. spillway - elev 54.8

4. 100 yr flow - needs to pass thru structure w/ 1' free bd.

E.S. could be set @ 54.8

2/27/01 - Mtg to Discuss E+S Control-

Dam will need to be rebuilt

Rational + SCS storm - 0.65' diff - 10 yr.
1.1 diff - 100 yr

Appendix A. Current Impervious Cover Estimates for Powhatan Creek

Table A-1. Current Impervious Cover Estimates for the Subwatersheds Within Powhatan Creek Watershed

Subwatershed ID	Subwatershed Area (ac)	Road Area (ac)	Parking Area (ac)	Building Area (ac)	# of houses	Driveway Area (ac)	Sidewalk Area (ac)	Misc IC (ac)	Total IC (ac)	IC (%)
201	835.72	21.70	9.11	10.00	78	2.10	2.44	1.93	47.28	5.7
202	601.41	18.11	2.63	5.60	72	2.68	1.65	1.43	32.10	5.3
203	849.39	35.91	9.85	23.85	87	5.26	4.26	3.08	82.21	9.7
204	540.86	20.35	7.36	13.96	121	7.01	2.79	1.84	53.31	9.9
205	1619.19	26.99	11.96	22.11	449	9.29	4.01	5.18	79.54	4.9
206	1316.65	59.70	29.77	41.83	623	17.13	8.46	8.90	165.79	12.6
302	2850.80	81.30	107.95	104.72	736	23.10	18.07	15.36	350.50	12.3
209	1083.19	25.13	0.32	13.79	138	3.04	2.41	2.28	46.97	4.3
210	716.76	16.69	20.35	28.21	182	4.01	3.94	3.48	76.68	10.7
IC = Impervious Cover										

FACILITY G Dam Design

1. VDOT - Concerned about raising the dam

- " " permanent water in bottom
- Don't want to have too much water because of lack of impervious core
- 3' high riser structure
- Prefer no micro pool

We can live w/out a permanent pool -

W Q orifice could be @ elev 47.2

VDOT will maintain the pond

Pond will be rerun

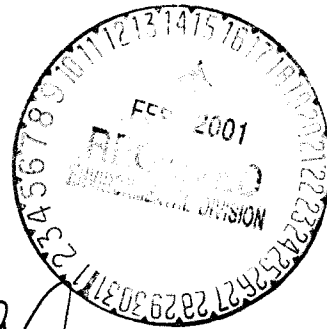
- criteria - keep riser $\leq 3'$
- no micropool
- no permanent pool
- water qual. orifice @ elev 47.0
- emer. spillway @ 10 yr. elev
- strive to keep max. flooded depth to 4'

Developer will bore dam to determine if core trench, impervious core present - 2 borings

Sediment Basin - how is this handled

- meeting to determine how this will be handled.

Memorandum



DATE: January 3, 2001

TO: Quinton Elliott – Virginia Department of Transportation

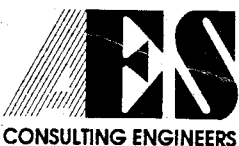
FROM: Charles Records, Richard Costello - AES Consulting Engineers

SUBJECT: Williamsburg Plantation/VDOT Joint Facility "G"

OVERVIEW & SUMMARY

We have shown the existing VDOT Pond and four (4) different sets of information for the Joint Pond. The 1994 MMM Pond design shown here was prepared then as a joint pond in response to pond site concerns raised by Williamsburg Plantation (WP) but never incorporated into VDOT Plans. Eventually WP's approved pond site from the 1986 Master Plan was condemned and used by VDOT for their Pond for Route 199. Since there is no other natural site for a Pond, VDOT agreed during condemnation negotiations in 1999 that this site should be a joint Pond. In 1999 AES designed a joint pond in accordance with SCS requirements per JCC standards. This information previously submitted to VDOT has raised many concerns due to its high flows and high operating (elevation) levels. This memo is written to show the **significant differences in design results due to the two different methods (VDOT/Rational & JCC/SCS) used to design and calculate pond operating characteristics.** This memo also shows the difference water quality causes in the pond design since **JCC required additional water quality measures to be incorporated into the pond.** The major purpose of this memo is to show the major differences in joint pond operating characteristics between the JCC SCS method and the VDOT Rational Method.

We have shown the major characteristics of the Ponds in a table on the next page. The current VDOT pond is shown as Existing. The MMM joint Pond designed in 1994 is labeled as Pond 1. The major differences from the MMM design for the other joint Ponds are due to water quality requirements and differences in runoff between the two methods. The pond is larger due to more runoff from the SCS method (that larger size is a given and is used with the Rational designs). Due to water quality issues, the pond always holds 1 foot of water because the elevation of the lower orifice was raised 1 foot. Also the pond drains slower due to the primary orifice being reduced in size from 9SF to 2.5 SF. In Pond 1A AES has shown how the pond operates by the **Rational method** assuming the 1' higher low flow orifice. Pond 2 shows how the pond operates by the **Rational Method** also assuming the smaller high-level orifice. Pond 1A & 2 calculations are attached to this memo.



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Pond 2A is what was submitted last year to VDOT & JCC. Pond 2A is the same as Pond 2 but was previously designed using the SCS/JCC methodology. This table shows the significant differences in operating characteristics due to SCS & JCC methodology.

In summary I believe there is not significant differences between the MMM joint pond design (Pond 1) and the more recent AES designs (Pond 1A & 2) other than the 1 foot of standing water. All ponds drain down to their 4" diameter low flow orifices in less than 24 hours.

Stormwater Management Pond Highwater and Peak Outflow Value Comparison Tables

Pond Number		Existing	1	1A	2	2A
	Storm Event (yr)	MMM (Rational) No Orifice	MMM-1994 (Rational) 9 SF Orifice	AES-2000 (Rational) 9 SF Orifice	AES-2000 (Rational) 2.2 SF Orifice	AES-1999 (JCC/SCS) 2.2 SF Orifice
Highwater Elevation (feet)	2-yr.	50.1	50.6	51.1	52.1	52.9
	10-yr.	50.4	51.2	51.9	53.4	54.8
	25-yr.	50.7	51.9	52.3	53.8	55.5
	100-yr.	51.3	53.2	53.1	54.2	56.4
Spillway Elevations	Low flow Orifice	47	47	48	48	48
	High Flow Orifice	None	49.4	50	50	50
	Principle	49.4	53	53	53	53
	Emergency	54.1	54.1	55.4	55.4	55.4
Peak Outflow from Pond (cfs)	2-yr.	No info.	34.3	35.7	15.7	18.5
	10-yr.	No info.	50.2	51.7	30.2	114.3
	25-yr.	No info.	62.6	59.3	45.6	148.9
	100-yr.	No info.	87.0	71.4	69.0	242.6

Note: The drainage area has remained the same for all calculations except for existing, which is approximately 50% of the others. The Existing pond has the least amount of volume with #1's pond volume being somewhat smaller than the others, which are all the same size.

FURTHER EXPLANATION

The purpose of this memo is to answer outstanding issues concerning the above referenced project in VDOT's in-house-review. As you are well aware, various BMP design iterations that have been proposed for this project. The designs have been compared on the previous page.

1. The 1994 MMM Design - Rational Method / 9 SF orifice
- 1A The 2000 AES Design (for this memo) - Rational Method / 9 SF orifice
2. The 2000 AES Design (for this memo) - Rational Method / 2.25 SF orifice
- 2A The 1999 AES Design (prev. subm.)- **SCS/JCC Method** / 2.25 SF orifice

In an effort to bring closure to these issues, this memo and Calculations #1A and #2 are attached. Calculation 2A was previously submitted and really is not germane to this review. The in-house VDOT memo raised the following issues of concern: safety, liability, structural integrity and drainage calculation discrepancies. These issues referred to Pond #2A, which is the SCS/JCC design. The first to be reviewed is the drainage discrepancies, which indirectly affect all of the VDOT issues.

VDOT engineers are concerned with calculation discrepancies in comparison of Pond 1 MMM to Pond 2A AES- (JCC/SCS). Calculation 2A was designed per the James City County Stormwater Management Design Standards using the SCS methodology for determining flowrates. As is obvious when reviewing the table, SCS methodology is extremely conservative when compared to the Rational method. Iteration 1A & 2 are based upon VDOT design guidelines using the Rational Method. From a safety standpoint, the side slopes and the pond depth have either remained the same or been improved when compared to the VDOT design (#1 above). The proposed AES basin has side slopes ranging from 2:1 to 2.5:1 and the original VDOT design calculations for the entire pond indicate it is to have 2:1 side slopes. **The side slopes in the VDOT right-of-way are not disturbed and remain unchanged.** Although the AES designs have added a sediment forebay per JCC requirements, the depth of the pond has not changed throughout all of the iterations of the basin from the first MMM joint design. The existing VDOT guardrail along Route 199 protecting the basin is not shown on the AES plans.

The VDOT liability associated with this basin (Calculation 1A & 2) are approximately the same as the original Pond (Calculation 1) with stormwater elevations changing less than 1 foot for the maximum design storm.

Structural integrity of the dam was another concern. The extension of the riser to elevation 53 will not compromise the integrity of the base of the principal spillway. The integrity of the dam structure will remain the same as it has been. The dam can easily withstand a permanent pool of 1.0' of water, and the phreatic line associated with a pool depth of 1' will remain well under the toe of the existing dam on the downstream side. During the 100 year storm Design 2 is only 1' higher than design 1, which is not significant. The pond drains down within 24 hours to the 4" low flow orifice so infiltration will not occur through the dam. Lastly pertaining to maintenance concerns, there is an orifice at the elevation needed to drain the pond entirely pond when needed.

If you have any questions or concerns, please feel free to contact Richard Costello or me at 253-0040. I look forward to working with you to complete this project.

Italics by RAC

DRAFT COMMENTS (for internal use only)

Subject: Williamsburg Plantation Section V (SP-103-00)
James City County

1. The proposed basin has 2:1 side slopes on all sides (slopes should be no steeper than 3:1 for mowing) and will have a ponded water depth of 8 to 9 feet deep. (ponded depth should be no greater than 3 to 4 feet due to the hazard) This would greatly increase any liability. *Existing slopes are all 2:1. The slopes that are revised (which are all outside of the R/W) are flattened to 2.5:1. During the 100yr storm the existing Pond is 4.3' deep. The proposed pond (not including the forebay) will be 7.2' deep. 2' is due to the increased drainage area, 1' is due to the 4' orifice being raised 1' and the remaining 1' due to the upper orifice being 2.2SF in conjunction with the primary spillway being raised 3'.*
2. The emergency spillway should be armored. (rip rap over filter cloth or paving). *When calculations are done using the Modified Rational Method no water goes over the emergency spillway, therefore armoring is not required.*
3. The computations do not match the plans. The actual performance of the basin is unknown. *We have attached revised calculations using the Modified Rational Method. The other calcs were what JCC requires.*
4. The basin will be wet if the 4" orifice is raised to elevation 48'. The volume of storage up to elevation 48' should not be included in the routing computations. *Correct, we raised the orifice at the last moment rather than argue with JCC any more. With our current water quality points for the project we anticipate being able to lower the orifice back to 47 is VDOT desires.*

5. The basin as proposed will have a 1'+/- permanent pool depth covering 0.7'+/- of an acre. This would be an on going maintenance problem and a mosquito breeding pool. *See previous comment.*
6. There are no structural details on how the existing riser is proposed to be modified. The connection between the existing structure and the proposed needs to be shown. Will the existing foundation support the added weight/height of the riser? *The connection will be 4 rebar in the corners, which will be added to the plans. The existing foundation is 4' below grade, and the added weight is only 250 psf, which is not significant for this structure that is founded approximately 6' below the original ground at this location.*
7. The integrity of the dam needs to be addressed. (bottom of micropool to emergency spillway is 13.7', to top of dam 15.7') The existing basin was designed as a dry basin and not intended to have a permanent pool, so infiltration through the dam is a concern. The volume of water that is proposed to go to the proposed basin will almost double, this greatly increases the chance of failure. The dam should be rebuilt under our current criteria. (clay core, concrete cradle under pipe, flatter slopes etc.) *The actual dam is raised to 57.4 to deal with the JCC/SCS storm, however it actually does not need to be raised at all from 56 to deal with 100 year Rational Storm as the maximum water level is 54.2 (that is 1.8' of freeboard). If 1' of water is allowed to remain in the pond no impact from the revised phreatic line will occur (however as noted above the 1' of standing water can probably be eliminated.*
8. Downstream liability needs to be addressed. *No significant change.*
9. A 100yr. Flood elevation needs to be established around the basin, upstream of the basin and downstream of the dam. *It is not significant as the pond is well below the road and drains to the swamp which is also well below the road.*

10. What effects will the backwater from the basin have on drainage structures under Rte. 199? *None, whatsoever, 100 year level is at 54.2. Surface flow from the north side of the road enters a catch basin at elevation 61 and drainage from the median at elevation 64 and that from the from the south side even higher. The invert the 36" pipe entering the catch basin nearest the pond is 53.3 so head conditions will not be a problem.*

STORMWATER MANAGEMENT/ BMP CALCULATIONS
FOR
DRY POND WITH SHALLOW MARSH

COMBINED FACILITY
FOR
WILLIAMSBURG PLANTATION
AND
VDOT 199 – FACILITY “G”

Prepared By:
AES Consulting Engineers
5248 Olde Towne Road, Suite 1
Williamsburg, Virginia 23188
Submitted: February 26, 1999
Revised: January 3, 2001

Hydrograph Summary Report

Page 1

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Return period (yrs)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	51.8	1	733	225,039	2	—	—	—	2 YEAR PRE-DEV
2	SCS Runoff	116.2	1	733	482,602	10	—	—	—	10 YEAR PRE-DEV
3	SCS Runoff	151.1	1	732	624,143	25	—	—	—	25 YEAR PRE-DEV
4	SCS Runoff	216.2	1	732	891,574	100	—	—	—	100 YEAR PRE-DEV
5	SCS Runoff	98.1	5	725	346,869	2	—	—	—	2 YEAR POST-DEV
6	SCS Runoff	183.5	5	725	648,925	10	—	—	—	10 YEAR POST-DEV
7	SCS Runoff	227.0	5	725	806,819	25	—	—	—	25 YEAR POST-DEV
8	SCS Runoff	305.6	5	725	1,097,217	100	—	—	—	100 YEAR POST DEV
10	Rational	64.2	1	31	179,004	2	—	—	—	2 yr storm
11	Rational	90.9	1	31	253,600	10	—	—	—	10 yr storm
12	Rational	105.4	1	31	294,121	25	—	—	—	25 yr storm
13	Rational	128.5	1	31	358,397	100	—	—	—	100 yr storm
15	Reservoir	18.5	5	755	341,056	2	5	52.89	187,468	2 YR POST DEV ROUT
16	Reservoir	114.3	5	740	643,103	10	6	54.81	263,700	10 YR POST DEV ROU
17	Reservoir	148.9	5	735	800,994	25	7	55.53	295,605	25 YR POST DEV ROU
18	Reservoir	242.6	5	735	1,091,386	100	8	56.42	336,376	100 YR POST DEV RO
20	Reservoir	15.7	1	78	146,083	2	10	52.14	160,426	2 YR POST DEV ROUT
21	Reservoir	30.2	1	72	219,749	10	11	53.41	207,955	10 YR POST DEV ROU
22	Reservoir	45.6	1	66	260,175	25	12	53.75	221,384	25 YR POST DEV ROU
23	Reservoir	69.0	1	60	324,375	100	13	54.15	237,630	100 YR POST DEV RO
25	Reservoir	35.7	1	59	148,993	2	10	51.15	124,894	2 YR POST DEV ROUT
26	Reservoir	51.7	1	58	223,397	10	11	51.88	151,150	10 YR POST DEV ROU
27	Reservoir	59.3	1	58	263,819	25	12	52.32	166,972	25 YR POST DEV ROU
28	Reservoir	71.4	1	59	327,942	100	13	53.06	194,040	100 YR POST DEV RO

HYDROGRAPHS: 15-18 SCS METHOD (PREVIOUSLY SUBMITTED) 2SF ORIFICE
 20-23 RATIONAL 2 SF ORIFICE
 25-28 RATIONAL 9 SF ORIFICE

Proj. file: 755506DRYR.GPW

IDF file: JCChydrographs.IDF

Run date: 12-01-2000

**Rational Method
Post-Development Hydrographs**

Hydrograph Report

Page 1

English

Hyd. No. 10

2 yr storm

Hydrograph type = Rational
Storm frequency = 2 yrs
Drainage area = 47.0 ac
Intensity = 2.53 in
I-D-F Curve = JCChydrographs.IDF

Peak discharge = 64.16 cfs
Time interval = 1 min
Runoff coeff. = 0.54
Time of conc. (Tc) = 31 min
Reced. limb factor = 2

Hydrograph Discharge Table

Total Volume = 179,004 cuft

Time -- Outflow (hrs cfs)	Time -- Outflow (hrs cfs)	Time -- Outflow (hrs cfs)
0.07 8.28	0.60 58.99	1.13 25.87
0.08 10.35	0.62 57.95	1.15 24.84
0.10 12.42	0.63 56.92	1.17 23.80
0.12 14.49	0.65 55.88	1.18 22.77
0.13 16.56	0.67 54.85	1.20 21.73
0.15 18.63	0.68 53.81	1.22 20.70
0.17 20.70	0.70 52.78	1.23 19.66
0.18 22.77	0.72 51.74	1.25 18.63
0.20 24.84	0.73 50.71	1.27 17.59
0.22 26.91	0.75 49.67	1.28 16.56
0.23 28.98	0.77 48.64	1.30 15.52
0.25 31.04	0.78 47.60	1.32 14.49
0.27 33.11	0.80 46.57	1.33 13.45
0.28 35.18	0.82 45.53	1.35 12.42
0.30 37.25	0.83 44.50	1.37 11.38
0.32 39.32	0.85 43.46	1.38 10.35
0.33 41.39	0.87 42.43	1.40 9.31
0.35 43.46	0.88 41.39	1.42 8.28
0.37 45.53	0.90 40.36	1.43 7.24
0.38 47.60	0.92 39.32	
0.40 49.67	0.93 38.29	
0.42 51.74	0.95 37.25	...End
0.43 53.81	0.97 36.22	
0.45 55.88	0.98 35.18	
0.47 57.95	1.00 34.15	
0.48 60.02	1.02 33.11	
0.50 62.09	1.03 32.08	
0.52 64.16 <<	1.05 31.04	
0.53 63.12	1.07 30.01	
0.55 62.09	1.08 28.98	
0.57 61.05	1.10 27.94	
0.58 60.02	1.12 26.91	

Hydrograph Report

Page 1

English

Hyd. No. 11

10 yr storm

Hydrograph type = Rational
Storm frequency = 10 yrs
Drainage area = 47.0 ac
Intensity = 3.58 in
I-D-F Curve = JCChydrographs.IDF

Peak discharge = 90.90 cfs
Time interval = 1 min
Runoff coeff. = 0.54
Time of conc. (Tc) = 31 min
Reced. limb factor = 2

Hydrograph Discharge Table

Total Volume = 253,600 cuft

Time -- Outflow (hrs cfs)	Time -- Outflow (hrs cfs)	Time -- Outflow (hrs cfs)
0.07 11.73	0.60 83.57	1.13 36.65
0.08 14.66	0.62 82.10	1.15 35.19
0.10 17.59	0.63 80.63	1.17 33.72
0.12 20.52	0.65 79.17	1.18 32.25
0.13 23.46	0.67 77.70	1.20 30.79
0.15 26.39	0.68 76.24	1.22 29.32
0.17 29.32	0.70 74.77	1.23 27.86
0.18 32.25	0.72 73.30	1.25 26.39
0.20 35.19	0.73 71.84	1.27 24.92
0.22 38.12	0.75 70.37	1.28 23.46
0.23 41.05	0.77 68.91	1.30 21.99
0.25 43.98	0.78 67.44	1.32 20.52
0.27 46.91	0.80 65.97	1.33 19.06
0.28 49.85	0.82 64.51	1.35 17.59
0.30 52.78	0.83 63.04	1.37 16.13
0.32 55.71	0.85 61.57	1.38 14.66
0.33 58.64	0.87 60.11	1.40 13.19
0.35 61.57	0.88 58.64	1.42 11.73
0.37 64.51	0.90 57.18	1.43 10.26
0.38 67.44	0.92 55.71	
0.40 70.37	0.93 54.24	
0.42 73.30	0.95 52.78	...End
0.43 76.24	0.97 51.31	
0.45 79.17	0.98 49.85	
0.47 82.10	1.00 48.38	
0.48 85.03	1.02 46.91	
0.50 87.96	1.03 45.45	
0.52 90.90 <<	1.05 43.98	
0.53 89.43	1.07 42.52	
0.55 87.96	1.08 41.05	
0.57 86.50	1.10 39.58	
0.58 85.03	1.12 38.12	

Hydrograph Report

Page 1

English

Hyd. No. 12

25 yr storm

Hydrograph type = Rational
Storm frequency = 25 yrs
Drainage area = 47.0 ac
Intensity = 4.15 in
I-D-F Curve = JCChydrographs.IDF

Peak discharge = 105.42 cfs
Time interval = 1 min
Runoff coeff. = 0.54
Time of conc. (Tc) = 31 min
Reced. limb factor = 2

Hydrograph Discharge Table

Total Volume = 294,121 cuft

Time -- Outflow (hrs cfs)	Time -- Outflow (hrs cfs)	Time -- Outflow (hrs cfs)
0.07 13.60	0.60 96.92	1.13 42.51
0.08 17.00	0.62 95.22	1.15 40.81
0.10 20.40	0.63 93.52	1.17 39.11
0.12 23.80	0.65 91.82	1.18 37.41
0.13 27.21	0.67 90.12	1.20 35.71
0.15 30.61	0.68 88.42	1.22 34.01
0.17 34.01	0.70 86.72	1.23 32.31
0.18 37.41	0.72 85.02	1.25 30.61
0.20 40.81	0.73 83.32	1.27 28.91
0.22 44.21	0.75 81.62	1.28 27.21
0.23 47.61	0.77 79.92	1.30 25.50
0.25 51.01	0.78 78.21	1.32 23.80
0.27 54.41	0.80 76.51	1.33 22.10
0.28 57.81	0.82 74.81	1.35 20.40
0.30 61.21	0.83 73.11	1.37 18.70
0.32 64.61	0.85 71.41	1.38 17.00
0.33 68.01	0.87 69.71	1.40 15.30
0.35 71.41	0.88 68.01	1.42 13.60
0.37 74.81	0.90 66.31	1.43 11.90
0.38 78.21	0.92 64.61	
0.40 81.62	0.93 62.91	
0.42 85.02	0.95 61.21	...End
0.43 88.42	0.97 59.51	
0.45 91.82	0.98 57.81	
0.47 95.22	1.00 56.11	
0.48 98.62	1.02 54.41	
0.50 102.02	1.03 52.71	
0.52 105.42 <<	1.05 51.01	
0.53 103.72	1.07 49.31	
0.55 102.02	1.08 47.61	
0.57 100.32	1.10 45.91	
0.58 98.62	1.12 44.21	

Hydrograph Report

Page 1

English

Hyd. No. 13

100 yr storm

Hydrograph type = Rational
Storm frequency = 100 yrs
Drainage area = 47.0 ac
Intensity = 5.06 in
I-D-F Curve = JCChydrographs.IDF

Peak discharge = 128.46 cfs
Time interval = 1 min
Runoff coeff. = 0.54
Time of conc. (Tc) = 31 min
Reced. limb factor = 2

Hydrograph Discharge Table

Total Volume = 358,397 cuft

Time -- Outflow (hrs cfs)	Time -- Outflow (hrs cfs)	Time -- Outflow (hrs cfs)
0.07 16.58	0.60 118.10	1.13 51.80
0.08 20.72	0.62 116.03	1.15 49.73
0.10 24.86	0.63 113.95	1.17 47.65
0.12 29.01	0.65 111.88	1.18 45.58
0.13 33.15	0.67 109.81	1.20 43.51
0.15 37.29	0.68 107.74	1.22 41.44
0.17 41.44	0.70 105.67	1.23 39.37
0.18 45.58	0.72 103.60	1.25 37.29
0.20 49.73	0.73 101.52	1.27 35.22
0.22 53.87	0.75 99.45	1.28 33.15
0.23 58.01	0.77 97.38	1.30 31.08
0.25 62.16	0.78 95.31	1.32 29.01
0.27 66.30	0.80 93.24	1.33 26.93
0.28 70.44	0.82 91.16	1.35 24.86
0.30 74.59	0.83 89.09	1.37 22.79
0.32 78.73	0.85 87.02	1.38 20.72
0.33 82.88	0.87 84.95	1.40 18.65
0.35 87.02	0.88 82.88	1.42 16.58
0.37 91.16	0.90 80.80	1.43 14.50
0.38 95.31	0.92 78.73	
0.40 99.45	0.93 76.66	
0.42 103.60	0.95 74.59	...End
0.43 107.74	0.97 72.52	
0.45 111.88	0.98 70.44	
0.47 116.03	1.00 68.37	
0.48 120.17	1.02 66.30	
0.50 124.31	1.03 64.23	
0.52 128.46 <<	1.05 62.16	
0.53 126.39	1.07 60.09	
0.55 124.31	1.08 58.01	
0.57 122.24	1.10 55.94	
0.58 120.17	1.12 53.87	

**Rational Method
Pond Routings
2 SF Orifice**

Reservoir Report

Page 1

Reservoir No. 1 - REVISED POND SEPT 99

English

Pond Data

Pond storage is based on known contour areas

Stage / Storage Table

Stage ft	Elevation ft	Contour area sqft	Incr. Storage cuft	Total storage cuft
0.00	44.00	00	0	0
1.00	45.00	12	6	6
2.00	46.00	12	12	18
2.99	46.99	12	12	30
3.00	47.00	23,197	116	146
5.00	49.00	30,915	54,112	54,258
7.00	51.00	34,212	65,127	119,385
9.00	53.00	37,879	72,091	191,476
11.00	55.00	42,078	79,957	271,433
13.00	57.00	49,620	91,698	363,131

Culvert / Orifice Structures

	[A]	[B]	[C]	[D]
Rise in	= 42.0	4.0	6.0	0.0
Span in	= 42.0	4.0	18.0	0.0
No. Barrels	= 1	1	3	0
Invert El. ft	= 44.14	48.00	50.00	0.00
Length ft	= 45.0	0.5	0.5	0.0
Slope %	= 0.42	0.00	0.00	0.00
N-Value	= .013	.013	.013	.000
Orif. Coeff.	= 0.60	0.60	0.60	0.00
Multi-Stage	= ---	Yes	Yes	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len ft	= 12.5	30.0	0.0	0.0
Crest El. ft	= 53.00	55.40	0.00	0.00
Weir Coeff.	= 3.00	3.00	0.00	0.00
Eqn. Exp.	= 1.50	1.50	0.00	0.00
Multi-Stage	= Yes	No	No	No

Tailwater Elevation = 0.00 ft

Stage / Storage / Discharge Table

Note: All outflows have been analyzed under inlet and outlet control.

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Discharge cfs
0.00	0	44.00	0.00	0.00	0.00	---	0.00	0.00	---	---	0.00
1.00	6	45.00	4.76	0.00	0.00	---	0.00	0.00	---	---	0.00
2.00	18	46.00	13.96	0.00	0.00	---	0.00	0.00	---	---	0.00
2.99	30	46.99	22.69	0.00	0.00	---	0.00	0.00	---	---	0.00
3.00	146	47.00	48.87	0.00	0.00	---	0.00	0.00	---	---	0.00
5.00	54,258	49.00	81.69	0.38	0.00	---	0.00	0.00	---	---	0.38
7.00	119,385	51.00	104.71	0.71	9.38	---	0.00	0.00	---	---	10.09
9.00	191,476	53.00	123.51	0.92	17.97	---	0.00	0.00	---	---	18.89
11.00	271,433	55.00	139.81	0.74	18.96	---	106.07	0.00	---	---	125.76
13.00	363,131	57.00	154.39	0.00	0.00	---	300.00	182.15	---	---	336.54

Hydrograph Report

Page 1

English

Hyd. No. 20

2 YR POST DEV ROUTED

Hydrograph type = Reservoir
Storm frequency = 2 yrs
Inflow hyd. No. = 10
Max. Elevation = 52.14 ft

Peak discharge = 15.72 cfs
Time interval = 1 min
Reservoir name = REVISED POND SE
Max. Storage = 160,426 cuft

Storage Indication method used.

Total Volume = 146,083 cuft

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Outflow cfs
0.57	61.05	50.17	95.58	0.59	1.13	---	---	---	---	---	1.73
0.58	60.02	50.27	96.96	0.61	2.28	---	---	---	---	---	2.89
0.60	58.99	50.38	98.10	0.62	3.57	---	---	---	---	---	4.19
0.62	57.95	50.48	99.18	0.64	4.16	---	---	---	---	---	4.80
0.63	56.92	50.57	100.22	0.65	4.52	---	---	---	---	---	5.17
0.65	55.88	50.66	101.21	0.66	5.73	---	---	---	---	---	6.39
0.67	54.85	50.75	102.15	0.68	7.23	---	---	---	---	---	7.91
0.68	53.81	50.84	103.03	0.69	8.28	---	---	---	---	---	8.96
0.70	52.78	50.92	103.87	0.70	8.83	---	---	---	---	---	9.53
0.72	51.74	51.00	104.68	0.71	9.37	---	---	---	---	---	10.07
0.73	50.71	51.07	105.38	0.72	9.77	---	---	---	---	---	10.49
0.75	49.67	51.13	106.05	0.72	10.16	---	---	---	---	---	10.88
0.77	48.64	51.20	106.69	0.73	10.53	---	---	---	---	---	11.26
0.78	47.60	51.26	107.30	0.74	10.86	---	---	---	---	---	11.60
0.80	46.57	51.32	107.88	0.75	11.17	---	---	---	---	---	11.91
0.82	45.53	51.37	108.45	0.75	11.47	---	---	---	---	---	12.22
0.83	44.50	51.43	108.98	0.76	11.74	---	---	---	---	---	12.50
0.85	43.46	51.48	109.49	0.76	12.00	---	---	---	---	---	12.76
0.87	42.43	51.53	109.98	0.77	12.24	---	---	---	---	---	13.01
0.88	41.39	51.58	110.45	0.78	12.47	---	---	---	---	---	13.25
0.90	40.36	51.62	110.89	0.78	12.69	---	---	---	---	---	13.47
0.92	39.32	51.67	111.32	0.79	12.88	---	---	---	---	---	13.67
0.93	38.29	51.71	111.72	0.79	13.07	---	---	---	---	---	13.86
0.95	37.25	51.75	112.10	0.79	13.25	---	---	---	---	---	14.04
0.97	36.22	51.78	112.46	0.80	13.42	---	---	---	---	---	14.22
0.98	35.18	51.82	112.80	0.80	13.57	---	---	---	---	---	14.38
1.00	34.15	51.85	113.12	0.81	13.72	---	---	---	---	---	14.52
1.02	33.11	51.89	113.41	0.81	13.85	---	---	---	---	---	14.66
1.03	32.08	51.92	113.70	0.81	13.97	---	---	---	---	---	14.79
1.05	31.04	51.94	113.96	0.82	14.09	---	---	---	---	---	14.91
1.07	30.01	51.97	114.20	0.82	14.20	---	---	---	---	---	15.02
1.08	28.98	51.99	114.43	0.82	14.30	---	---	---	---	---	15.12
1.10	27.94	52.02	114.64	0.82	14.39	---	---	---	---	---	15.22
1.12	26.91	52.04	114.82	0.83	14.47	---	---	---	---	---	15.30
1.13	25.87	52.05	115.00	0.83	14.55	---	---	---	---	---	15.37
1.15	24.84	52.07	115.15	0.83	14.61	---	---	---	---	---	15.44

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Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Outflow cfs
1.17	23.80	52.09	115.29	0.83	14.67	---	---	---	---	---	15.50
1.18	22.77	52.10	115.41	0.83	14.72	---	---	---	---	---	15.56
1.20	21.73	52.11	115.51	0.83	14.77	---	---	---	---	---	15.60
1.22	20.70	52.12	115.60	0.84	14.80	---	---	---	---	---	15.64
1.23	19.66	52.13	115.67	0.84	14.83	---	---	---	---	---	15.67
1.25	18.63	52.13	115.72	0.84	14.86	---	---	---	---	---	15.69
1.27	17.59	52.14	115.76	0.84	14.87	---	---	---	---	---	15.71
1.28	16.56	52.14	115.78	0.84	14.88	---	---	---	---	---	15.72
1.30	15.52	52.14	115.78	0.84	14.88	---	---	---	---	---	15.72 <<
1.32	14.49	52.14	115.77	0.84	14.88	---	---	---	---	---	15.72
1.33	13.45	52.13	115.75	0.84	14.87	---	---	---	---	---	15.70
1.35	12.42	52.13	115.70	0.84	14.85	---	---	---	---	---	15.69
1.37	11.38	52.12	115.64	0.84	14.82	---	---	---	---	---	15.66
1.38	10.35	52.12	115.57	0.83	14.79	---	---	---	---	---	15.63
1.40	9.31	52.11	115.48	0.83	14.75	---	---	---	---	---	15.59
1.42	8.28	52.09	115.38	0.83	14.71	---	---	---	---	---	15.54
1.43	7.24	52.08	115.26	0.83	14.66	---	---	---	---	---	15.49
1.45	6.21	52.07	115.12	0.83	14.60	---	---	---	---	---	15.43
1.47	5.17	52.05	114.97	0.83	14.54	---	---	---	---	---	15.36
1.48	4.14	52.03	114.81	0.83	14.46	---	---	---	---	---	15.29
1.50	3.10	52.01	114.63	0.82	14.39	---	---	---	---	---	15.21
1.52	2.07	51.99	114.43	0.82	14.30	---	---	---	---	---	15.12
1.53	1.03	51.97	114.22	0.82	14.21	---	---	---	---	---	15.03
1.55	0.00	51.95	113.99	0.82	14.11	---	---	---	---	---	14.92
1.57	0.00	51.92	113.76	0.81	14.00	---	---	---	---	---	14.82
1.58	0.00	51.90	113.52	0.81	13.90	---	---	---	---	---	14.71
1.60	0.00	51.87	113.29	0.81	13.80	---	---	---	---	---	14.60
1.62	0.00	51.85	113.06	0.81	13.69	---	---	---	---	---	14.50
1.63	0.00	51.82	112.84	0.80	13.59	---	---	---	---	---	14.39
1.65	0.00	51.80	112.61	0.80	13.49	---	---	---	---	---	14.29
1.67	0.00	51.78	112.38	0.80	13.38	---	---	---	---	---	14.18
1.68	0.00	51.75	112.16	0.80	13.28	---	---	---	---	---	14.07
1.70	0.00	51.73	111.93	0.79	13.17	---	---	---	---	---	13.97
1.72	0.00	51.71	111.71	0.79	13.07	---	---	---	---	---	13.86
1.73	0.00	51.68	111.49	0.79	12.97	---	---	---	---	---	13.75
1.75	0.00	51.66	111.27	0.79	12.86	---	---	---	---	---	13.65
1.77	0.00	51.64	111.05	0.78	12.76	---	---	---	---	---	13.54
1.78	0.00	51.62	110.84	0.78	12.66	---	---	---	---	---	13.44
1.80	0.00	51.59	110.62	0.78	12.56	---	---	---	---	---	13.34
1.82	0.00	51.57	110.41	0.78	12.45	---	---	---	---	---	13.23
1.83	0.00	51.55	110.19	0.77	12.34	---	---	---	---	---	13.12
1.85	0.00	51.53	109.98	0.77	12.24	---	---	---	---	---	13.01
1.87	0.00	51.51	109.77	0.77	12.13	---	---	---	---	---	12.90
1.88	0.00	51.49	109.56	0.77	12.03	---	---	---	---	---	12.80
1.90	0.00	51.46	109.35	0.76	11.93	---	---	---	---	---	12.69
1.92	0.00	51.44	109.15	0.76	11.83	---	---	---	---	---	12.59
1.93	0.00	51.42	108.94	0.76	11.72	---	---	---	---	---	12.48
1.95	0.00	51.40	108.74	0.76	11.62	---	---	---	---	---	12.38
1.97	0.00	51.38	108.54	0.75	11.52	---	---	---	---	---	12.27

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Hydrograph Report

Page 1

English

Hyd. No. 21

10 YR POST DEV ROUTED

Hydrograph type = Reservoir
Storm frequency = 10 yrs
Inflow hyd. No. = 11
Max. Elevation = 53.41 ft

Peak discharge = 30.20 cfs
Time interval = 1 min
Reservoir name = REVISED POND SE
Max. Storage = 207,955 cuft

Storage Indication method used.

Total Volume = 219,749 cuft

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Outflow cfs
0.50	87.96	50.41	98.49	0.63	3.92	---	---	---	---	---	4.55
0.52	90.90 <<	50.57	100.17	0.65	4.50	---	---	---	---	---	5.16
0.53	89.43	50.72	101.81	0.67	6.69	---	---	---	---	---	7.36
0.55	87.96	50.87	103.36	0.69	8.49	---	---	---	---	---	9.18
0.57	86.50	51.01	104.83	0.71	9.45	---	---	---	---	---	10.16
0.58	85.03	51.14	106.10	0.72	10.19	---	---	---	---	---	10.91
0.60	83.57	51.26	107.32	0.74	10.87	---	---	---	---	---	11.61
0.62	82.10	51.38	108.49	0.75	11.49	---	---	---	---	---	12.25
0.63	80.63	51.49	109.62	0.77	12.06	---	---	---	---	---	12.83
0.65	79.17	51.60	110.71	0.78	12.60	---	---	---	---	---	13.38
0.67	77.70	51.71	111.74	0.79	13.08	---	---	---	---	---	13.87
0.68	76.24	51.81	112.75	0.80	13.55	---	---	---	---	---	14.35
0.70	74.77	51.92	113.70	0.81	13.98	---	---	---	---	---	14.79
0.72	73.30	52.01	114.63	0.82	14.39	---	---	---	---	---	15.21
0.73	71.84	52.11	115.51	0.83	14.77	---	---	---	---	---	15.60
0.75	70.37	52.20	116.37	0.84	15.14	---	---	---	---	---	15.98
0.77	68.91	52.29	117.18	0.85	15.47	---	---	---	---	---	16.33
0.78	67.44	52.38	117.97	0.86	15.80	---	---	---	---	---	16.66
0.80	65.97	52.46	118.72	0.87	16.10	---	---	---	---	---	16.97
0.82	64.51	52.54	119.44	0.88	16.39	---	---	---	---	---	17.27
0.83	63.04	52.62	120.14	0.89	16.67	---	---	---	---	---	17.55
0.85	61.57	52.69	120.80	0.89	16.92	---	---	---	---	---	17.82
0.87	60.11	52.76	121.43	0.90	17.17	---	---	---	---	---	18.07
0.88	58.64	52.83	122.03	0.91	17.40	---	---	---	---	---	18.31
0.90	57.18	52.90	122.61	0.91	17.62	---	---	---	---	---	18.54
0.92	55.71	52.96	123.16	0.92	17.83	---	---	---	---	---	18.75
0.93	54.24	53.02	123.66	0.93	18.02	---	0.30	---	---	---	19.25
0.95	52.78	53.07	124.10	0.93	18.19	---	1.15	---	---	---	20.27
0.97	51.31	53.12	124.51	0.93	18.34	---	1.94	---	---	---	21.21
0.98	49.85	53.16	124.88	0.94	18.48	---	2.67	---	---	---	22.08
1.00	48.38	53.20	125.23	0.94	18.60	---	3.34	---	---	---	22.88
1.02	46.91	53.24	125.53	0.95	18.72	---	4.43	---	---	---	24.10
1.03	45.45	53.27	125.81	0.95	18.82	---	5.43	---	---	---	25.19
1.05	43.98	53.30	126.05	0.95	18.91	---	6.30	---	---	---	26.16
1.07	42.52	53.32	126.27	0.95	18.98	---	7.07	---	---	---	27.01
1.08	41.05	53.34	126.45	0.96	19.05	---	7.73	---	---	---	27.74

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Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Outflow cfs
1.10	39.58	53.36	126.61	0.96	19.11	---	8.30	---	---	---	28.36
1.12	38.12	53.38	126.74	0.96	19.16	---	8.77	---	---	---	28.88
1.13	36.65	53.39	126.84	0.96	19.19	---	9.15	---	---	---	29.30
1.15	35.19	53.40	126.92	0.96	19.22	---	9.45	---	---	---	29.63
1.17	33.72	53.41	126.98	0.96	19.24	---	9.71	---	---	---	29.92
1.18	32.25	53.41	127.02	0.96	19.26	---	9.89	---	---	---	30.11
1.20	30.79	53.41 <<	127.04	0.96	19.26	---	9.97	---	---	---	30.20 <<
1.22	29.32	53.41	127.04	0.96	19.26	---	9.96	---	---	---	30.19
1.23	27.86	53.41	127.02	0.96	19.26	---	9.87	---	---	---	30.09
1.25	26.39	53.41	126.98	0.96	19.24	---	9.70	---	---	---	29.90
1.27	24.92	53.40	126.93	0.96	19.23	---	9.46	---	---	---	29.65
1.28	23.46	53.39	126.86	0.96	19.20	---	9.22	---	---	---	29.38
1.30	21.99	53.38	126.78	0.96	19.17	---	8.92	---	---	---	29.05
1.32	20.52	53.37	126.68	0.96	19.13	---	8.57	---	---	---	28.66
1.33	19.06	53.36	126.57	0.96	19.09	---	8.17	---	---	---	28.22
1.35	17.59	53.34	126.45	0.96	19.05	---	7.73	---	---	---	27.73
1.37	16.13	53.33	126.31	0.95	19.00	---	7.24	---	---	---	27.19
1.38	14.66	53.31	126.17	0.95	18.95	---	6.71	---	---	---	26.61
1.40	13.19	53.29	126.01	0.95	18.89	---	6.14	---	---	---	25.98
1.42	11.73	53.27	125.84	0.95	18.83	---	5.53	---	---	---	25.31
1.43	10.26	53.25	125.66	0.95	18.76	---	4.89	---	---	---	24.60
1.45	8.80	53.23	125.47	0.95	18.69	---	4.21	---	---	---	23.85
1.47	7.33	53.20	125.28	0.94	18.62	---	3.51	---	---	---	23.07
1.48	5.86	53.18	125.07	0.94	18.55	---	3.03	---	---	---	22.52
1.50	4.40	53.15	124.85	0.94	18.46	---	2.60	---	---	---	22.00
1.52	2.93	53.13	124.61	0.94	18.38	---	2.14	---	---	---	21.45
1.53	1.47	53.10	124.37	0.93	18.28	---	1.67	---	---	---	20.88
1.55	0.00	53.07	124.11	0.93	18.19	---	1.17	---	---	---	20.29
1.57	0.00	53.04	123.85	0.93	18.09	---	0.66	---	---	---	19.68
1.58	0.00	53.01	123.60	0.92	18.00	---	0.18	---	---	---	19.10
1.60	0.00	52.98	123.33	0.92	17.90	---	---	---	---	---	18.82
1.62	0.00	52.95	123.06	0.92	17.80	---	---	---	---	---	18.71
1.63	0.00	52.92	122.79	0.92	17.69	---	---	---	---	---	18.61
1.65	0.00	52.89	122.52	0.91	17.59	---	---	---	---	---	18.50
1.67	0.00	52.86	122.25	0.91	17.49	---	---	---	---	---	18.40
1.68	0.00	52.83	121.98	0.91	17.39	---	---	---	---	---	18.29
1.70	0.00	52.80	121.72	0.90	17.28	---	---	---	---	---	18.19
1.72	0.00	52.77	121.45	0.90	17.18	---	---	---	---	---	18.08
1.73	0.00	52.74	121.18	0.90	17.08	---	---	---	---	---	17.97
1.75	0.00	52.71	120.92	0.89	16.97	---	---	---	---	---	17.87
1.77	0.00	52.68	120.66	0.89	16.87	---	---	---	---	---	17.76
1.78	0.00	52.65	120.39	0.89	16.77	---	---	---	---	---	17.66
1.80	0.00	52.62	120.13	0.89	16.67	---	---	---	---	---	17.55
1.82	0.00	52.59	119.87	0.88	16.56	---	---	---	---	---	17.45
1.83	0.00	52.56	119.61	0.88	16.46	---	---	---	---	---	17.34
1.85	0.00	52.53	119.35	0.88	16.35	---	---	---	---	---	17.23
1.87	0.00	52.50	119.10	0.87	16.25	---	---	---	---	---	17.13
1.88	0.00	52.47	118.84	0.87	16.15	---	---	---	---	---	17.02
1.90	0.00	52.44	118.59	0.87	16.05	---	---	---	---	---	16.92

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Hydrograph Report

Page 1

English

Hyd. No. 22

25 YR POST DEV ROUTED

Hydrograph type = Reservoir
Storm frequency = 25 yrs
Inflow hyd. No. = 12
Max. Elevation = 53.75 ft

Peak discharge = 45.65 cfs
Time interval = 1 min
Reservoir name = REVISED POND SE
Max. Storage = 221,384 cuft

Storage Indication method used.

Total Volume = 260,175 cuft

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Outflow cfs
0.47	95.22	50.44	98.77	0.63	4.01	----	----	----	----	----	4.65
0.48	98.62	50.61	100.59	0.66	4.73	----	----	----	----	----	5.39
0.50	102.02	50.78	102.41	0.68	7.65	----	----	----	----	----	8.33
0.52	105.42 <<	50.95	104.22	0.70	9.06	----	----	----	----	----	9.76
0.53	103.72	51.11	105.87	0.72	10.06	----	----	----	----	----	10.78
0.55	102.02	51.27	107.40	0.74	10.91	----	----	----	----	----	11.65
0.57	100.32	51.42	108.88	0.76	11.69	----	----	----	----	----	12.45
0.58	98.62	51.56	110.29	0.77	12.39	----	----	----	----	----	13.17
0.60	96.92	51.70	111.64	0.79	13.04	----	----	----	----	----	13.83
0.62	95.22	51.84	112.95	0.80	13.64	----	----	----	----	----	14.45
0.63	93.52	51.97	114.20	0.82	14.20	----	----	----	----	----	15.02
0.65	91.82	52.10	115.40	0.83	14.72	----	----	----	----	----	15.55
0.67	90.12	52.22	116.56	0.85	15.21	----	----	----	----	----	16.06
0.68	88.42	52.34	117.67	0.86	15.67	----	----	----	----	----	16.53
0.70	86.72	52.46	118.74	0.87	16.11	----	----	----	----	----	16.98
0.72	85.02	52.58	119.77	0.88	16.52	----	----	----	----	----	17.40
0.73	83.32	52.69	120.76	0.89	16.91	----	----	----	----	----	17.80
0.75	81.62	52.79	121.71	0.90	17.28	----	----	----	----	----	18.18
0.77	79.92	52.90	122.62	0.91	17.63	----	----	----	----	----	18.54
0.78	78.21	53.00	123.50	0.92	17.96	----	----	----	----	----	18.89
0.80	76.51	53.09	124.25	0.93	18.24	----	1.43	----	----	----	20.60
0.82	74.81	53.17	124.95	0.94	18.50	----	2.80	----	----	----	22.24
0.83	73.11	53.24	125.60	0.95	18.74	----	4.67	----	----	----	24.35
0.85	71.41	53.31	126.20	0.95	18.96	----	6.82	----	----	----	26.73
0.87	69.71	53.38	126.74	0.96	19.16	----	8.79	----	----	----	28.90
0.88	68.01	53.44	127.23	0.96	19.33	----	10.89	----	----	----	31.19
0.90	66.31	53.49	127.67	0.97	19.49	----	12.97	----	----	----	33.43
0.92	64.61	53.53	128.06	0.97	19.63	----	14.82	----	----	----	35.42
0.93	62.91	53.58	128.41	0.98	19.76	----	16.45	----	----	----	37.19
0.95	61.21	53.61	128.71	0.98	19.86	----	17.97	----	----	----	38.82
0.97	59.51	53.64	128.97	0.98	19.95	----	19.44	----	----	----	40.38
0.98	57.81	53.67	129.19	0.99	20.03	----	20.68	----	----	----	41.70
1.00	56.11	53.69	129.37	0.99	20.10	----	21.72	----	----	----	42.80
1.02	54.41	53.71	129.52	0.99	20.15	----	22.57	----	----	----	43.70
1.03	52.71	53.72	129.64	0.99	20.19	----	23.24	----	----	----	44.42
1.05	51.01	53.73	129.73	0.99	20.22	----	23.74	----	----	----	44.96

Continues on next page...

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Outflow cfs
1.07	49.31	53.74	129.79	0.99	20.24	---	24.10	---	---	---	45.33
1.08	47.61	53.75	129.83	0.99	20.26	---	24.31	---	---	---	45.56
1.10	45.91	53.75	129.84	0.99	20.26	---	24.39	---	---	---	45.65 <<
1.12	44.21	53.75	129.84	0.99	20.26	---	24.35	---	---	---	45.60
1.13	42.51	53.74	129.81	0.99	20.25	---	24.20	---	---	---	45.44
1.15	40.81	53.74	129.76	0.99	20.23	---	23.94	---	---	---	45.17
1.17	39.11	53.73	129.70	0.99	20.21	---	23.59	---	---	---	44.79
1.18	37.41	53.72	129.62	0.99	20.18	---	23.14	---	---	---	44.32
1.20	35.71	53.71	129.53	0.99	20.15	---	22.62	---	---	---	43.76
1.22	34.01	53.70	129.42	0.99	20.11	---	22.01	---	---	---	43.11
1.23	32.31	53.68	129.30	0.99	20.07	---	21.33	---	---	---	42.39
1.25	30.61	53.67	129.17	0.99	20.03	---	20.59	---	---	---	41.60
1.27	28.91	53.65	129.03	0.98	19.98	---	19.78	---	---	---	40.74
1.28	27.21	53.63	128.88	0.98	19.92	---	18.92	---	---	---	39.82
1.30	25.50	53.61	128.72	0.98	19.86	---	18.01	---	---	---	38.85
1.32	23.80	53.59	128.55	0.98	19.80	---	17.10	---	---	---	37.88
1.33	22.10	53.57	128.36	0.98	19.74	---	16.24	---	---	---	36.95
1.35	20.40	53.55	128.17	0.97	19.67	---	15.33	---	---	---	35.97
1.37	18.70	53.52	127.97	0.97	19.60	---	14.38	---	---	---	34.95
1.38	17.00	53.50	127.76	0.97	19.52	---	13.39	---	---	---	33.89
1.40	15.30	53.47	127.55	0.97	19.45	---	12.37	---	---	---	32.78
1.42	13.60	53.45	127.32	0.97	19.37	---	11.31	---	---	---	31.64
1.43	11.90	53.42	127.09	0.96	19.28	---	10.22	---	---	---	30.47
1.45	10.20	53.39	126.85	0.96	19.20	---	9.19	---	---	---	29.34
1.47	8.50	53.36	126.60	0.96	19.11	---	8.29	---	---	---	28.35
1.48	6.80	53.33	126.35	0.95	19.01	---	7.36	---	---	---	27.33
1.50	5.10	53.30	126.08	0.95	18.92	---	6.40	---	---	---	26.27
1.52	3.40	53.27	125.81	0.95	18.82	---	5.41	---	---	---	25.18
1.53	1.70	53.23	125.52	0.95	18.71	---	4.40	---	---	---	24.06
1.55	0.00	53.20	125.24	0.94	18.61	---	3.36	---	---	---	22.91
1.57	0.00	53.17	124.94	0.94	18.50	---	2.79	---	---	---	22.23
1.58	0.00	53.13	124.66	0.94	18.39	---	2.24	---	---	---	21.57
1.60	0.00	53.10	124.38	0.93	18.29	---	1.70	---	---	---	20.93
1.62	0.00	53.07	124.12	0.93	18.19	---	1.18	---	---	---	20.30
1.63	0.00	53.04	123.86	0.93	18.10	---	0.68	---	---	---	19.70
1.65	0.00	53.01	123.61	0.92	18.00	---	0.19	---	---	---	19.12
1.67	0.00	52.98	123.34	0.92	17.90	---	---	---	---	---	18.82
1.68	0.00	52.95	123.07	0.92	17.80	---	---	---	---	---	18.72
1.70	0.00	52.92	122.80	0.92	17.70	---	---	---	---	---	18.61
1.72	0.00	52.89	122.53	0.91	17.59	---	---	---	---	---	18.51
1.73	0.00	52.86	122.26	0.91	17.49	---	---	---	---	---	18.40
1.75	0.00	52.83	121.99	0.91	17.39	---	---	---	---	---	18.30
1.77	0.00	52.80	121.73	0.90	17.29	---	---	---	---	---	18.19
1.78	0.00	52.77	121.46	0.90	17.18	---	---	---	---	---	18.08
1.80	0.00	52.74	121.19	0.90	17.08	---	---	---	---	---	17.98
1.82	0.00	52.71	120.93	0.90	16.98	---	---	---	---	---	17.87
1.83	0.00	52.68	120.66	0.89	16.87	---	---	---	---	---	17.76
1.85	0.00	52.65	120.40	0.89	16.77	---	---	---	---	---	17.66
1.87	0.00	52.62	120.14	0.89	16.67	---	---	---	---	---	17.56

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Hydrograph Report

Page 1

English

Hyd. No. 23

100 YR POST DEV ROUTED

Hydrograph type = Reservoir
Storm frequency = 100 yrs
Inflow hyd. No. = 13
Max. Elevation = 54.15 ft

Peak discharge = 69.04 cfs
Time interval = 1 min
Reservoir name = REVISED POND SE
Max. Storage = 237,630 cuft

Storage Indication method used.

Total Volume = 324,375 cuft

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Outflow cfs
0.45	111.88	50.75	102.09	0.67	7.14	---	---	---	---	---	7.82
0.47	116.03	50.94	104.11	0.70	8.99	---	---	---	---	---	9.69
0.48	120.17	51.13	106.00	0.72	10.13	---	---	---	---	---	10.85
0.50	124.31	51.31	107.85	0.74	11.15	---	---	---	---	---	11.90
0.52	128.46 <<	51.50	109.72	0.77	12.11	---	---	---	---	---	12.88
0.53	126.39	51.69	111.56	0.79	13.00	---	---	---	---	---	13.79
0.55	124.31	51.88	113.33	0.81	13.81	---	---	---	---	---	14.62
0.57	122.24	52.06	115.02	0.83	14.56	---	---	---	---	---	15.39
0.58	120.17	52.23	116.65	0.85	15.25	---	---	---	---	---	16.10
0.60	118.10	52.40	118.21	0.86	15.90	---	---	---	---	---	16.76
0.62	116.03	52.57	119.71	0.88	16.50	---	---	---	---	---	17.38
0.63	113.95	52.73	121.15	0.90	17.06	---	---	---	---	---	17.96
0.65	111.88	52.89	122.54	0.91	17.60	---	---	---	---	---	18.51
0.67	109.81	53.04	123.84	0.93	18.09	---	0.64	---	---	---	19.65
0.68	107.74	53.17	124.97	0.94	18.51	---	2.85	---	---	---	22.30
0.70	105.67	53.29	126.03	0.95	18.90	---	6.22	---	---	---	26.07
0.72	103.60	53.41	127.01	0.96	19.25	---	9.82	---	---	---	30.04
0.73	101.52	53.51	127.89	0.97	19.57	---	14.01	---	---	---	34.55
0.75	99.45	53.61	128.70	0.98	19.86	---	17.89	---	---	---	38.72
0.77	97.38	53.70	129.41	0.99	20.11	---	21.95	---	---	---	43.04
0.78	95.31	53.77	130.05	0.99	20.33	---	25.57	---	---	---	46.90
0.80	93.24	53.84	130.61	1.00	20.53	---	29.05	---	---	---	50.58
0.82	91.16	53.90	131.10	1.01	20.70	---	32.24	---	---	---	53.95
0.83	89.09	53.95	131.53	1.01	20.85	---	35.02	---	---	---	56.88
0.85	87.02	54.00	131.90	1.01	20.97	---	37.42	---	---	---	59.41
0.87	84.95	54.04	132.21	1.02	21.08	---	39.66	---	---	---	61.75
0.88	82.88	54.07	132.46	1.02	21.17	---	41.53	---	---	---	63.72
0.90	80.80	54.09	132.67	1.02	21.24	---	43.06	---	---	---	65.33
0.92	78.73	54.12	132.84	1.02	21.30	---	44.28	---	---	---	66.61
0.93	76.66	54.13	132.97	1.03	21.34	---	45.22	---	---	---	67.59
0.95	74.59	54.14	133.06	1.03	21.37	---	45.90	---	---	---	68.30
0.97	72.52	54.15	133.12	1.03	21.39	---	46.35	---	---	---	68.77
0.98	70.44	54.15	133.15	1.03	21.40	---	46.58	---	---	---	69.01
1.00	68.37	54.15	133.16	1.03	21.41	---	46.61	---	---	---	69.04 <<
1.02	66.30	54.15	133.14	1.03	21.40	---	46.47	---	---	---	68.89
1.03	64.23	54.15	133.10	1.03	21.38	---	46.16	---	---	---	68.57

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**Rational Method
Pond Routings
9 SF Orifice**

Reservoir Report

Page 1

Reservoir No. 4 - REVISED POND JAN 2000

English

Pond Data

Pond storage is based on known contour areas

Stage / Storage Table

Stage ft	Elevation ft	Contour area sqft	Incr. Storage cuft	Total storage cuft
0.00	44.00	00	0	0
1.00	45.00	12	6	6
2.00	46.00	12	12	18
2.99	46.99	12	12	30
3.00	47.00	23,197	116	146
5.00	49.00	30,915	54,112	54,258
7.00	51.00	34,212	65,127	119,385
9.00	53.00	37,879	72,091	191,476
11.00	55.00	42,078	79,957	271,433
13.00	57.00	49,620	91,698	363,131

Culvert / Orifice Structures

	[A]	[B]	[C]	[D]
Rise in	= 42.0	4.0	12.0	0.0
Span in	= 42.0	4.0	36.0	0.0
No. Barrels	= 1	1	3	0
Invert El. ft	= 44.14	48.00	50.00	0.00
Length ft	= 45.0	0.5	0.5	0.0
Slope %	= 0.42	0.00	0.00	0.00
N-Value	= .013	.013	.013	.000
Orif. Coeff.	= 0.60	0.60	0.60	0.00
Multi-Stage	= ---	Yes	Yes	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len ft	= 12.5	30.0	0.0	0.0
Crest El. ft	= 53.00	55.40	0.00	0.00
Weir Coeff.	= 3.00	3.00	0.00	0.00
Eqn. Exp.	= 1.50	1.50	0.00	0.00
Multi-Stage	= Yes	No	No	No

Tailwater Elevation = 0.00 ft

Stage / Storage / Discharge Table

Note: All outflows have been analyzed under inlet and outlet control.

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Discharge cfs
0.00	0	44.00	0.00	0.00	0.00	---	0.00	0.00	---	---	0.00
1.00	6	45.00	4.76	0.00	0.00	---	0.00	0.00	---	---	0.00
2.00	18	46.00	13.96	0.00	0.00	---	0.00	0.00	---	---	0.00
2.99	30	46.99	22.69	0.00	0.00	---	0.00	0.00	---	---	0.00
3.00	146	47.00	48.87	0.00	0.00	---	0.00	0.00	---	---	0.00
5.00	54,258	49.00	81.69	0.38	0.00	---	0.00	0.00	---	---	0.38
7.00	119,385	51.00	104.71	0.71	30.64	---	0.00	0.00	---	---	31.35
9.00	191,476	53.00	123.51	0.92	68.52	---	0.00	0.00	---	---	69.44
11.00	271,433	55.00	139.81	0.57	59.10	---	106.07	0.00	---	---	139.81
13.00	363,131	57.00	154.39	0.00	0.00	---	300.00	182.15	---	---	336.54

Hydrograph Report

Page 1

English

Hyd. No. 25

2 YR POST DEV ROUTED

Hydrograph type = Reservoir
Storm frequency = 2 yrs
Inflow hyd. No. = 10
Max. Elevation = 51.15 ft

Peak discharge = 35.66 cfs
Time interval = 1 min
Reservoir name = REVISED POND JA
Max. Storage = 124,894 cuft

Storage Indication method used.

Total Volume = 148,993 cuft

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Outflow cfs
0.58	60.02	50.27	96.91	0.61	4.44	---	---	---	---	---	5.05
0.60	58.99	50.37	97.99	0.62	6.90	---	---	---	---	---	7.52
0.62	57.95	50.46	98.99	0.64	9.61	---	---	---	---	---	10.24
0.63	56.92	50.54	99.90	0.65	12.35	---	---	---	---	---	12.99
0.65	55.88	50.62	100.73	0.66	14.98	---	---	---	---	---	15.63
0.67	54.85	50.69	101.47	0.67	17.69	---	---	---	---	---	18.36
0.68	53.81	50.75	102.15	0.68	20.15	---	---	---	---	---	20.83
0.70	52.78	50.81	102.76	0.68	22.43	---	---	---	---	---	23.11
0.72	51.74	50.86	103.29	0.69	24.68	---	---	---	---	---	25.37
0.73	50.71	50.91	103.77	0.70	26.68	---	---	---	---	---	27.37
0.75	49.67	50.95	104.18	0.70	28.44	---	---	---	---	---	29.14
0.77	48.64	50.98	104.55	0.71	29.98	---	---	---	---	---	30.69
0.78	47.60	51.01	104.85	0.71	31.05	---	---	---	---	---	31.76
0.80	46.57	51.04	105.11	0.71	31.75	---	---	---	---	---	32.46
0.82	45.53	51.06	105.33	0.71	32.37	---	---	---	---	---	33.08
0.83	44.50	51.08	105.53	0.72	32.91	---	---	---	---	---	33.63
0.85	43.46	51.10	105.70	0.72	33.39	---	---	---	---	---	34.10
0.87	42.43	51.11	105.84	0.72	33.79	---	---	---	---	---	34.51
0.88	41.39	51.12	105.97	0.72	34.13	---	---	---	---	---	34.85
0.90	40.36	51.13	106.07	0.72	34.40	---	---	---	---	---	35.13
0.92	39.32	51.14	106.14	0.72	34.62	---	---	---	---	---	35.34
0.93	38.29	51.15	106.20	0.73	34.78	---	---	---	---	---	35.50
0.95	37.25	51.15	106.24	0.73	34.88	---	---	---	---	---	35.60
0.97	36.22	51.15	106.26	0.73	34.93	---	---	---	---	---	35.66
0.98	35.18	51.15 <<	106.26	0.73	34.93	---	---	---	---	---	35.66 <<
1.00	34.15	51.15	106.24	0.73	34.89	---	---	---	---	---	35.61
1.02	33.11	51.15	106.21	0.73	34.80	---	---	---	---	---	35.52
1.03	32.08	51.14	106.16	0.72	34.66	---	---	---	---	---	35.39
1.05	31.04	51.14	106.10	0.72	34.49	---	---	---	---	---	35.21
1.07	30.01	51.13	106.02	0.72	34.27	---	---	---	---	---	35.00
1.08	28.98	51.12	105.93	0.72	34.02	---	---	---	---	---	34.75
1.10	27.94	51.11	105.83	0.72	33.74	---	---	---	---	---	34.46
1.12	26.91	51.10	105.71	0.72	33.42	---	---	---	---	---	34.13
1.13	25.87	51.09	105.58	0.72	33.06	---	---	---	---	---	33.78
1.15	24.84	51.07	105.44	0.72	32.68	---	---	---	---	---	33.39
1.17	23.80	51.06	105.29	0.71	32.26	---	---	---	---	---	32.98

Continues on next page...

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Outflow cfs
1.18	22.77	51.04	105.13	0.71	31.82	---	---	---	---	---	32.53
1.20	21.73	51.03	104.96	0.71	31.35	---	---	---	---	---	32.06
1.22	20.70	51.01	104.78	0.71	30.86	---	---	---	---	---	31.56
1.23	19.66	50.99	104.58	0.71	30.12	---	---	---	---	---	30.83
1.25	18.63	50.97	104.37	0.70	29.22	---	---	---	---	---	29.92
1.27	17.59	50.95	104.15	0.70	28.31	---	---	---	---	---	29.01
1.28	16.56	50.93	103.93	0.70	27.39	---	---	---	---	---	28.09
1.30	15.52	50.90	103.71	0.69	26.46	---	---	---	---	---	27.15
1.32	14.49	50.88	103.49	0.69	25.52	---	---	---	---	---	26.21
1.33	13.45	50.86	103.27	0.69	24.58	---	---	---	---	---	25.27
1.35	12.42	50.84	103.04	0.69	23.62	---	---	---	---	---	24.31
1.37	11.38	50.82	102.81	0.68	22.67	---	---	---	---	---	23.35
1.38	10.35	50.79	102.58	0.68	21.73	---	---	---	---	---	22.41
1.40	9.31	50.77	102.35	0.68	20.87	---	---	---	---	---	21.55
1.42	8.28	50.75	102.11	0.68	20.00	---	---	---	---	---	20.67
1.43	7.24	50.73	101.86	0.67	19.11	---	---	---	---	---	19.79
1.45	6.21	50.70	101.62	0.67	18.22	---	---	---	---	---	18.89
1.47	5.17	50.68	101.37	0.67	17.32	---	---	---	---	---	17.98
1.48	4.14	50.66	101.12	0.66	16.41	---	---	---	---	---	17.07
1.50	3.10	50.63	100.87	0.66	15.49	---	---	---	---	---	16.15
1.52	2.07	50.61	100.61	0.66	14.56	---	---	---	---	---	15.22
1.53	1.03	50.58	100.35	0.65	13.72	---	---	---	---	---	14.37
1.55	0.00	50.56	100.08	0.65	12.92	---	---	---	---	---	13.56
1.57	0.00	50.53	99.82	0.65	12.13	---	---	---	---	---	12.77
1.58	0.00	50.51	99.58	0.64	11.39	---	---	---	---	---	12.03
1.60	0.00	50.49	99.34	0.64	10.69	---	---	---	---	---	11.33
1.62	0.00	50.47	99.13	0.64	10.03	---	---	---	---	---	10.67
1.63	0.00	50.45	98.92	0.63	9.41	---	---	---	---	---	10.05
1.65	0.00	50.43	98.73	0.63	8.83	---	---	---	---	---	9.46
1.67	0.00	50.42	98.54	0.63	8.28	---	---	---	---	---	8.91
1.68	0.00	50.40	98.37	0.63	7.76	---	---	---	---	---	8.39
1.70	0.00	50.39	98.20	0.63	7.38	---	---	---	---	---	8.01
1.72	0.00	50.37	98.05	0.62	7.02	---	---	---	---	---	7.64
1.73	0.00	50.36	97.89	0.62	6.68	---	---	---	---	---	7.30
1.75	0.00	50.34	97.75	0.62	6.35	---	---	---	---	---	6.97
1.77	0.00	50.33	97.61	0.62	6.03	---	---	---	---	---	6.65
1.78	0.00	50.32	97.48	0.62	5.73	---	---	---	---	---	6.35
1.80	0.00	50.31	97.35	0.61	5.45	---	---	---	---	---	6.06
1.82	0.00	50.30	97.23	0.61	5.17	---	---	---	---	---	5.78
1.83	0.00	50.29	97.12	0.61	4.91	---	---	---	---	---	5.52
1.85	0.00	50.28	97.01	0.61	4.66	---	---	---	---	---	5.27
1.87	0.00	50.27	96.90	0.61	4.42	---	---	---	---	---	5.03
1.88	0.00	50.26	96.80	0.61	4.20	---	---	---	---	---	4.80
1.90	0.00	50.25	96.71	0.61	3.98	---	---	---	---	---	4.59
1.92	0.00	50.24	96.62	0.61	3.77	---	---	---	---	---	4.38
1.93	0.00	50.23	96.53	0.60	3.58	---	---	---	---	---	4.18
1.95	0.00	50.23	96.45	0.60	3.39	---	---	---	---	---	3.99
1.97	0.00	50.22	96.37	0.60	3.21	---	---	---	---	---	3.81
1.98	0.00	50.21	96.29	0.60	3.03	---	---	---	---	---	3.64

Continues on next page...

Hydrograph Report

Page 1

English

Hyd. No. 26

10 YR POST DEV ROUTED

Hydrograph type = Reservoir
Storm frequency = 10 yrs
Inflow hyd. No. = 11
Max. Elevation = 51.88 ft

Peak discharge = 51.71 cfs
Time interval = 1 min
Reservoir name = REVISED POND JA
Max. Storage = 151,150 cuft

Storage Indication method used.

Total Volume = 223,397 cuft

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Outflow cfs
0.50	87.96	50.40	98.40	0.63	7.84	---	---	---	---	---	8.47
0.52	90.90 <<	50.55	99.96	0.65	12.54	---	---	---	---	---	13.19
0.53	89.43	50.68	101.42	0.67	17.50	---	---	---	---	---	18.17
0.55	87.96	50.81	102.74	0.68	22.37	---	---	---	---	---	23.06
0.57	86.50	50.92	103.92	0.70	27.33	---	---	---	---	---	28.03
0.58	85.03	51.02	104.95	0.71	31.32	---	---	---	---	---	32.03
0.60	83.57	51.11	105.81	0.72	33.70	---	---	---	---	---	34.43
0.62	82.10	51.19	106.61	0.73	35.91	---	---	---	---	---	36.64
0.63	80.63	51.26	107.35	0.74	36.54	---	---	---	---	---	37.28
0.65	79.17	51.33	108.05	0.75	36.87	---	---	---	---	---	37.62
0.67	77.70	51.40	108.73	0.76	37.19	---	---	---	---	---	37.94
0.68	76.24	51.46	109.34	0.76	39.78	---	---	---	---	---	40.55
0.70	74.77	51.52	109.89	0.77	42.11	---	---	---	---	---	42.88
0.72	73.30	51.57	110.38	0.77	44.18	---	---	---	---	---	44.95
0.73	71.84	51.61	110.82	0.78	45.73	---	---	---	---	---	46.51
0.75	70.37	51.65	111.20	0.78	46.52	---	---	---	---	---	47.31
0.77	68.91	51.69	111.56	0.79	47.25	---	---	---	---	---	48.04
0.78	67.44	51.72	111.87	0.79	47.90	---	---	---	---	---	48.69
0.80	65.97	51.75	112.16	0.80	48.48	---	---	---	---	---	49.28
0.82	64.51	51.78	112.41	0.80	49.00	---	---	---	---	---	49.80
0.83	63.04	51.80	112.63	0.80	49.45	---	---	---	---	---	50.25
0.85	61.57	51.82	112.81	0.80	49.81	---	---	---	---	---	50.62
0.87	60.11	51.84	112.97	0.81	50.12	---	---	---	---	---	50.93
0.88	58.64	51.85	113.10	0.81	50.37	---	---	---	---	---	51.18
0.90	57.18	51.86	113.21	0.81	50.58	---	---	---	---	---	51.38
0.92	55.71	51.87	113.29	0.81	50.73	---	---	---	---	---	51.54
0.93	54.24	51.88	113.34	0.81	50.83	---	---	---	---	---	51.64
0.95	52.78	51.88	113.37	0.81	50.89	---	---	---	---	---	51.70
0.97	51.31	51.88 <<	113.37	0.81	50.90	---	---	---	---	---	51.71 <<
0.98	49.85	51.88	113.36	0.81	50.86	---	---	---	---	---	51.67
1.00	48.38	51.88	113.32	0.81	50.79	---	---	---	---	---	51.60
1.02	46.91	51.87	113.25	0.81	50.67	---	---	---	---	---	51.48
1.03	45.45	51.86	113.17	0.81	50.51	---	---	---	---	---	51.32
1.05	43.98	51.85	113.07	0.81	50.31	---	---	---	---	---	51.12
1.07	42.52	51.84	112.95	0.80	50.07	---	---	---	---	---	50.88
1.08	41.05	51.82	112.81	0.80	49.80	---	---	---	---	---	50.60

Continues on next page...

Hydrograph Report

Page 1

English

Hyd. No. 27

25 YR POST DEV ROUTED

Hydrograph type = Reservoir
Storm frequency = 25 yrs
Inflow hyd. No. = 12
Max. Elevation = 52.32 ft

Peak discharge = 59.30 cfs
Time interval = 1 min
Reservoir name = REVISED POND JA
Max. Storage = 166,972 cuft

Storage Indication method used.

Total Volume = 263,819 cuft

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Outflow cfs
0.47	95.22	50.43	98.66	0.63	8.64	----	----	----	----	----	9.27
0.48	98.62	50.58	100.35	0.65	13.72	----	----	----	----	----	14.38
0.50	102.02	50.74	101.97	0.67	19.51	----	----	----	----	----	20.18
0.52	105.42 <<	50.89	103.52	0.69	25.65	----	----	----	----	----	26.34
0.53	103.72	51.02	104.93	0.71	31.26	----	----	----	----	----	31.97
0.55	102.02	51.14	106.10	0.72	34.50	----	----	----	----	----	35.22
0.57	100.32	51.25	107.19	0.74	36.47	----	----	----	----	----	37.20
0.58	98.62	51.35	108.22	0.75	36.95	----	----	----	----	----	37.70
0.60	96.92	51.45	109.19	0.76	39.12	----	----	----	----	----	39.88
0.62	95.22	51.54	110.07	0.77	42.86	----	----	----	----	----	43.63
0.63	93.52	51.62	110.87	0.78	45.83	----	----	----	----	----	46.61
0.65	91.82	51.69	111.59	0.79	47.32	----	----	----	----	----	48.11
0.67	90.12	51.76	112.27	0.80	48.71	----	----	----	----	----	49.51
0.68	88.42	51.83	112.89	0.80	49.96	----	----	----	----	----	50.76
0.70	86.72	51.89	113.46	0.81	51.06	----	----	----	----	----	51.87
0.72	85.02	51.95	113.98	0.82	52.08	----	----	----	----	----	52.90
0.73	83.32	52.00	114.47	0.82	53.02	----	----	----	----	----	53.85
0.75	81.62	52.04	114.91	0.83	53.83	----	----	----	----	----	54.66
0.77	79.92	52.09	115.30	0.83	54.57	----	----	----	----	----	55.40
0.78	78.21	52.13	115.66	0.84	55.23	----	----	----	----	----	56.07
0.80	76.51	52.16	115.99	0.84	55.83	----	----	----	----	----	56.67
0.82	74.81	52.19	116.28	0.84	56.36	----	----	----	----	----	57.21
0.83	73.11	52.22	116.53	0.85	56.82	----	----	----	----	----	57.66
0.85	71.41	52.24	116.75	0.85	57.20	----	----	----	----	----	58.05
0.87	69.71	52.26	116.94	0.85	57.54	----	----	----	----	----	58.39
0.88	68.01	52.28	117.10	0.85	57.81	----	----	----	----	----	58.67
0.90	66.31	52.30	117.22	0.85	58.04	----	----	----	----	----	58.89
0.92	64.61	52.31	117.32	0.85	58.21	----	----	----	----	----	59.07
0.93	62.91	52.31	117.39	0.86	58.34	----	----	----	----	----	59.19
0.95	61.21	52.32	117.44	0.86	58.41	----	----	----	----	----	59.27
0.97	59.51	52.32 <<	117.45	0.86	58.44	----	----	----	----	----	59.30 <<
0.98	57.81	52.32	117.44	0.86	58.43	----	----	----	----	----	59.28
1.00	56.11	52.32	117.41	0.86	58.37	----	----	----	----	----	59.22
1.02	54.41	52.31	117.35	0.86	58.26	----	----	----	----	----	59.11
1.03	52.71	52.30	117.27	0.85	58.11	----	----	----	----	----	58.97
1.05	51.01	52.29	117.16	0.85	57.92	----	----	----	----	----	58.78

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Hydrograph Report

Page 1

English

Hyd. No. 28

100 YR POST DEV ROUTED

Hydrograph type = Reservoir
Storm frequency = 100 yrs
Inflow hyd. No. = 13
Max. Elevation = 53.06 ft

Peak discharge = 71.39 cfs
Time interval = 1 min
Reservoir name = REVISED POND JA
Max. Storage = 194,040 cuft

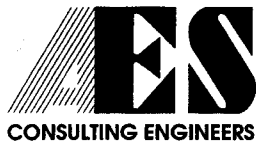
Storage Indication method used.

Total Volume = 327,942 cuft

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Outflow cfs
0.42	103.60	50.37	97.99	0.62	6.90	---	---	---	---	---	7.53
0.43	107.74	50.54	99.90	0.65	12.36	---	---	---	---	---	13.00
0.45	111.88	50.71	101.73	0.67	18.64	---	---	---	---	---	19.31
0.47	116.03	50.88	103.49	0.69	25.52	---	---	---	---	---	26.21
0.48	120.17	51.04	105.13	0.71	31.81	---	---	---	---	---	32.52
0.50	124.31	51.19	106.61	0.73	35.90	---	---	---	---	---	36.64
0.52	128.46 <<	51.34	108.09	0.75	36.89	---	---	---	---	---	37.64
0.53	126.39	51.48	109.53	0.76	40.59	---	---	---	---	---	41.35
0.55	124.31	51.62	110.86	0.78	45.80	---	---	---	---	---	46.58
0.57	122.24	51.74	112.06	0.79	48.29	---	---	---	---	---	49.08
0.58	120.17	51.86	113.19	0.81	50.54	---	---	---	---	---	51.35
0.60	118.10	51.97	114.24	0.82	52.57	---	---	---	---	---	53.39
0.62	116.03	52.08	115.21	0.83	54.40	---	---	---	---	---	55.23
0.63	113.95	52.18	116.12	0.84	56.08	---	---	---	---	---	56.92
0.65	111.88	52.27	116.97	0.85	57.59	---	---	---	---	---	58.44
0.67	109.81	52.35	117.76	0.86	58.98	---	---	---	---	---	59.84
0.68	107.74	52.43	118.49	0.87	60.25	---	---	---	---	---	61.12
0.70	105.67	52.51	119.16	0.88	61.40	---	---	---	---	---	62.27
0.72	103.60	52.58	119.79	0.88	62.46	---	---	---	---	---	63.35
0.73	101.52	52.64	120.36	0.89	63.42	---	---	---	---	---	64.31
0.75	99.45	52.70	120.89	0.89	64.29	---	---	---	---	---	65.19
0.77	97.38	52.76	121.38	0.90	65.09	---	---	---	---	---	65.99
0.78	95.31	52.81	121.82	0.90	65.81	---	---	---	---	---	66.72
0.80	93.24	52.85	122.22	0.91	66.45	---	---	---	---	---	67.36
0.82	91.16	52.89	122.57	0.91	67.02	---	---	---	---	---	67.93
0.83	89.09	52.93	122.89	0.92	67.53	---	---	---	---	---	68.45
0.85	87.02	52.96	123.17	0.92	67.98	---	---	---	---	---	68.90
0.87	84.95	52.99	123.42	0.92	68.38	---	---	---	---	---	69.30
0.88	82.88	53.01	123.62	0.92	68.68	---	0.21	---	---	---	69.82
0.90	80.80	53.03	123.77	0.93	68.92	---	0.50	---	---	---	70.35
0.92	78.73	53.04	123.89	0.93	69.11	---	0.73	---	---	---	70.77
0.93	76.66	53.05	123.98	0.93	69.24	---	0.91	---	---	---	71.08
0.95	74.59	53.06	124.03	0.93	69.33	---	1.02	---	---	---	71.28
0.97	72.52	53.06	124.06	0.93	69.38	---	1.07	---	---	---	71.38
0.98	70.44	53.06 <<	124.06	0.93	69.38	---	1.08	---	---	---	71.39 <<
1.00	68.37	53.06	124.04	0.93	69.34	---	1.03	---	---	---	71.30

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5248 Olde Towne Road • Suite 1 • Williamsburg, Virginia 23188
(757) 253-0040 • Fax (757) 220-8994 • E-mail aes@aesva.com

September 29, 1999

Mr. Darryl E. Cook, Environmental Director
James City County
101-E Mounts Bay Road
Williamsburg, Virginia 23185

**RE: VDOT/Williamsburg Plantation Combined Dry Pond
AES Project No. 7555-6**

Dear Mr. Cook:

Please find enclosed three sets of revised 11"x17" plans and two sets of revised calculations for the above mentioned project. The revisions are in response to your letter dated August 25th and are discussed below.

1. The elevation of the water quality orifice has been raised to EL 48.0 in order to provide the required storage volume for the shallow marsh. The provided storage volume of 27,056 cubic feet is in excess of the required volume of 25,259 cubic feet. Calculations are provided for the incremental storage of the BMP and have been adjusted such that the storage volume of the micro-pool is not included. The micro-pool volume had previously yielded false storage capacities. Please see "Reservoir Report No. 2 – Storage Pond Sept 99."
2. The first level of stormwater management releases (3 – 0.5'x1.5' slots) have been raised to EL 50.0, which provides a storage volume of 86,676 cubic feet. This volume exceeds the required 1" – 24 hour detention requirement by 33,787 cubic feet. The excess storage is provided in response to the Environmental Division's acceptance of the lesser marsh surface area.

Additional revisions to the pond design include the principle spillway elevation (now EL 53.0), the emergency spillway elevation (now EL 55.4), and the top of dam elevation (now 57.4). These changes are the result of the raised water quality orifice, and are noted on the enclosed plan sheets.

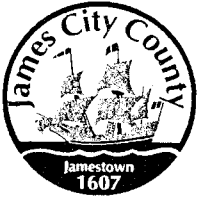
Should you have any questions regarding the plans or the pond design calculations, please contact me at 253-0040. I would be happy to discuss your concerns.

*Wmbg Plant will make
modif. to pond when they
develop in its watershed.*

Sincerely,
AES Consulting Engineers

Deirdre P. Wells, P.E.
Project Engineer

Enclosures



DEVELOPMENT MANAGEMENT

101-E MOUNTS BAY ROAD, P.O. BOX 8784, WILLIAMSBURG, VIRGINIA 23187-8784
(757) 253-6671 Fax: (757) 253-6850 E-MAIL: devtman@james-city.va.us

CODE COMPLIANCE
(757) 253-6626
codecomp@james-city.va.us

ENVIRONMENTAL DIVISION
(757) 253-6670
environ@james-city.va.us

PLANNING
(757) 253-6685
planning@james-city.va.us

COUNTY ENGINEER
(757) 253-6678
INTEGRATED PEST MANAGEMENT
(757) 253-2620

December 30, 1999

Ms. Deirdre Wells
AES Consulting Engineers
5248 Olde Towne Road
Suite 1
Williamsburg, VA 23188

RE: Williamsburg Plantation/VDOT Combined Dry Pond

Dear Ms. Wells:

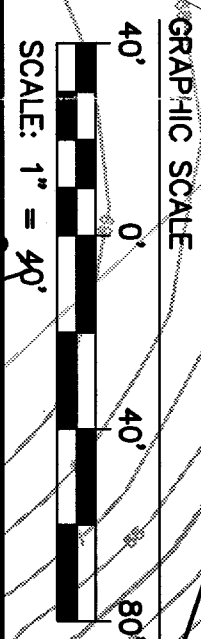
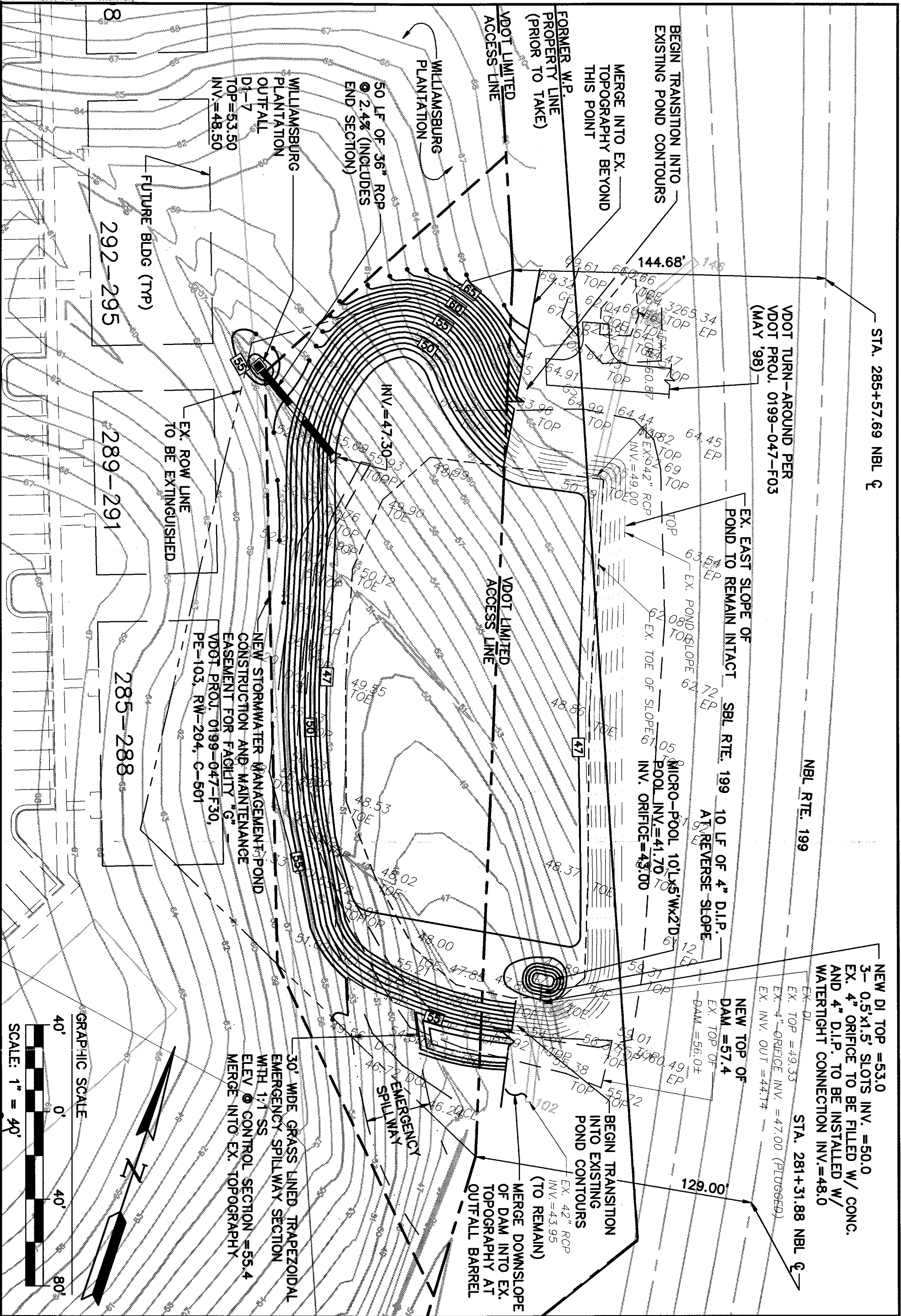
You submitted design information to document the modification of a dry pond called Facility G, built to serve a portion of the Route 199, to enable it to serve a portion of the Williamsburg Plantation project. The modifications involved converting the dry basin to a shallow marsh detention basin to meet the County's water quality requirements for a 9-point BMP under the Chesapeake Bay Preservation Ordinance.

The modifications as contained in the final set of calculations dated September 29, 1999, with accompanying drawings dated 2/22/99 with a final revision date of 9/28/99 are approved. At the appropriate time, these proposed modifications will need to be incorporated into site plan drawings for the first area of Williamsburg Plantation that will drain into the Facility G.

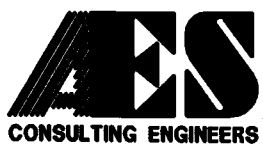
If you have any questions or there is further action needed on my part, please contact me at 253-6673.

Sincerely,

Darryl E. Cook, P.E.
Environmental Director



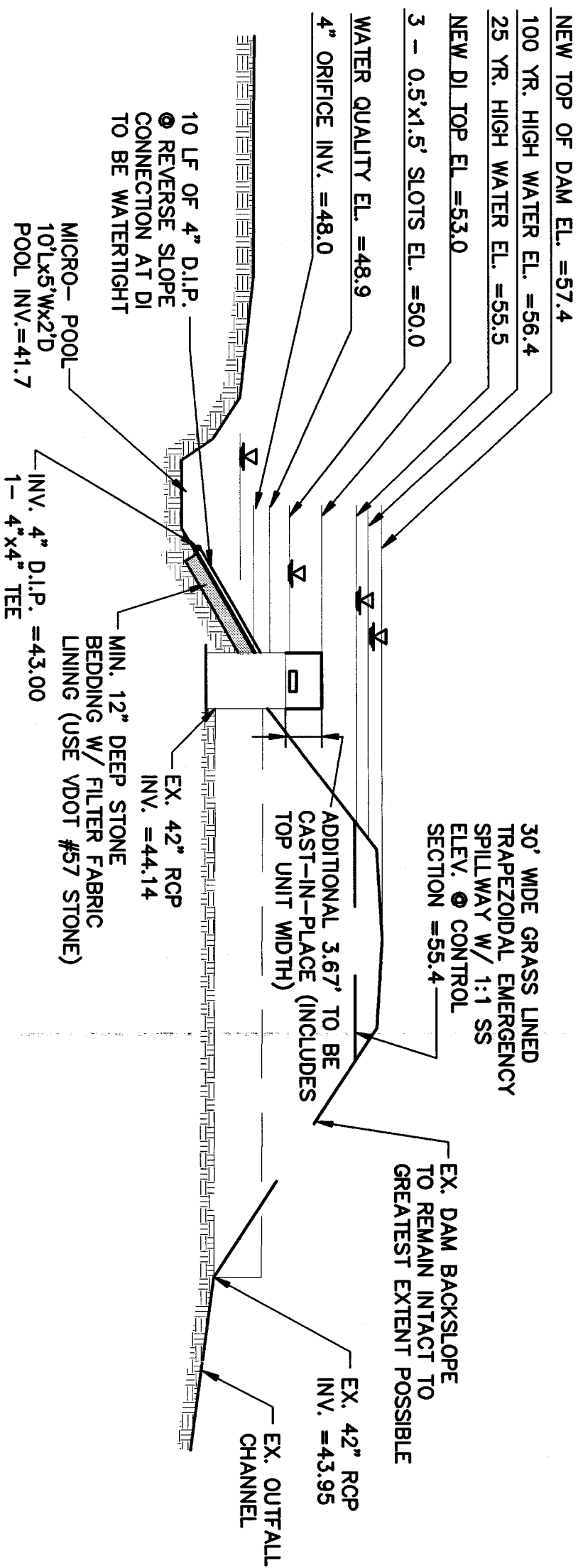
SITE PLAN
WILLIAMSBURG PLANTATION
VDOT/ WILLIAMSBURG PLANTATION COMBINED DRY POND
OWNER / DEVELOPER: WILLIAMSBURG PLANTATION, INC.
BERKELEY DISTRICT JAMES CITY COUNTY VIRGINIA



5248 Olde Towne Road, Suite 1
Williamsburg, Virginia 23188
(757) 253-0040
Fax (757) 220-8994

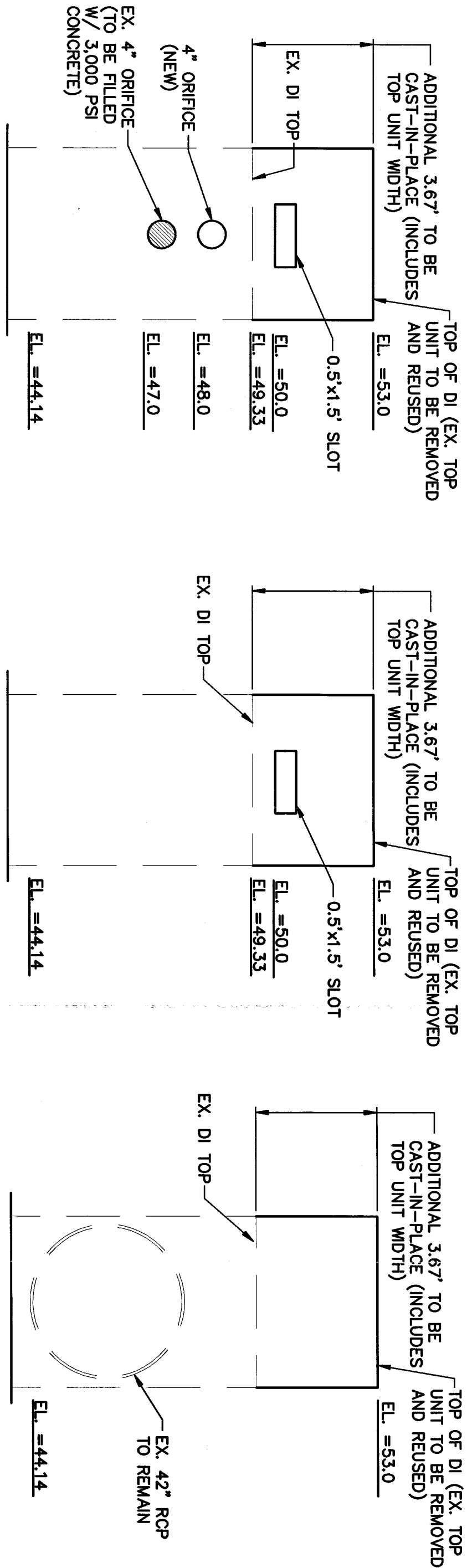


No.	DATE	REVISION / COMMENT / NOTE	BY
2	9/28/99	REVISED PER JCC 8/25/99 LETTER	DPW
1	5/28/99	REVISED PER VDOT REQUEST	DPW



SECTION THROUGH OUTLET STRUCTURE
N.T.S.

N.T.S.



NORTH FACE
DI OUTLET STRUCTURE
N.T.S.

EAST AND WEST FACES
DI OUTLET STRUCTURE
N.T.S.

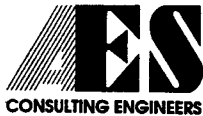
SOUTH FACE
DI OUTLET STRUCTURE
N.T.S.

**STORMWATER MANAGEMENT/ BMP CALCULATIONS
FOR
DRY POND**

WILLIAMSBURG PLANTATION/ VDOT RT 199

AES PROJECT #7555-6

Prepared By:
AES Consulting Engineers
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September 29, 1999



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PROJECT WILLIAMSBURG PLANTATION
PROJECT NO. 7555-6
SUBJECT DRY POND w/ MARSH DESIGN
SHEET NO. 1 OF 11
CALCULATED BY DPW DATE 9/27/99

DETERMINE DRAINAGE AREA SERVED BY POND

W.P. AREA = 21.09 AC± (FROM "OVERALL STORMWATER MANAGEMENT PLAN" DATED 11/91 BY AES)

199 AREA = 27.30 AC± (FROM "DRAINAGE STUDY FOR COMBINED SWM FACILITIES w/ W.P. DEVELOPMENT" DATED 5/94 BY MMM)
AREA "G"

TOTAL = 48.39 AC

* ASSUME THAT 1.432 AC IS INCLUDED IN BOTH DRAINAGE AREAS.
THIS IS THE AREA OF VDOT CONDEMNATION ALONG THE EASTERN
R. OF W.P.

∴ TOTAL DA = 48.39 - 1.432 = 46.958 AC

USE 47 AC ←

DETERMINE % IMPERVIOUS AREA (POST-DEV)

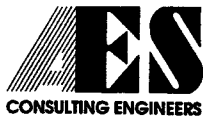
W.P. AREA = 8.75 AC± (FROM RECENT CAD DWG'S CIRCA 1997)
- 0.22 AC (AREA OF 6 BLDG'S LOST DUE TO
CONDEMNATION → 6(56' x 28'))
8.53 AC

199 AREA = 5.21 AC (FROM "EXHIBIT E" OF ABOVE REF'D STUDY)
+ .84 AC (ONLY 25.63 AC OF 27.30 AC IS ACCOUNTED
6.05 AC FOR ON EXH. E, ∴ ASSUME 50% OF
REMAINING 1.67 AC IS IMPERVIOUS)

TOTAL 14.58 AC

% IMP = $\frac{14.58}{47.0} (100) = 31.0\%$

31.0% IMP ←



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PROJECT VDOT/ W.P.
PROJECT NO. 7555-6
SUBJECT DRY POND W/ MARSH
SHEET NO. 2 OF 11
CALCULATED BY DPW DATE 9/27/99

DETERMINE RQD VOLUME OF POND FOR WATER QUALITY

DESIGN TYPE 4: DETAIN 1" FOR 24 HOURS

$$\text{RQD } \nabla = 1" (47\text{AL}) \left(\frac{1}{12} \right) (43560 \text{ SF/AL}) (0.310) \\ = \underline{52889 \text{ CF}}$$

THIS ∇ ACHIEVED @ EL = 48.9

→ JCC ENVIRONMENTAL DEPT REQUESTS DEWATERING ORIFICE
BE RAISED TO THE ELEV. RQD TO PROVIDE APPROPRIATE MARSH
VOLUME. ADDITIONALLY, STORAGE MUST BE PROVIDED
FOR THE VOLUME DISPLACED BY THE MARSH DEPTH

$$** \nabla \text{ VOLUME @ EL } 48.0 = 27,056 \text{ CF}$$

$$\nabla \text{ VOLUME @ EL } 47.0 = 0 \text{ CF}$$

$$\nabla \text{ VOLUME DISPLACED} = 27,056 \text{ CF}$$

(SEE PAGE 3
FOR MARSH
SIZING CALCS.)

$$\text{REVISED RQD VOLUME} = 52,889 + 27,056 \text{ CF} \\ = \underline{79,945 \text{ CF}} \leftarrow$$

** VOL. AVAILABLE @ EXIST. TOP OF DI, EL = 49.3 = 63,881 CF
NO! MUST RAISE TOP

** VOL OF 79,945 CF ACHIEVED AT EL = 49.8 ←

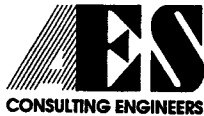
USE SLOTS @ EL 50 W/ STORAGE = 86,676 CF
THIS PROVIDES EXCESS STORAGE OF
 $86,676 - 52,889 = 33,787 \therefore \text{OK}$

DETERMINE ORIFICE SIZE FOR 24 HOUR RELEASE

$$\text{ORIFICE EL} = 48.0 \therefore \nabla \text{ VOL TO BE RELEASED} = 86,676 - 27,056 \text{ CF} \\ = 59,620 \text{ CF}$$

$$\text{QR} = \frac{59,620 \text{ CF}}{86,400 \text{ SEC}} = 0.69 \text{ CFS}$$

** REFER TO RESERVOIR REPORT FOR NO. 2 STORAGE POND (PG 8)



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PROJECT VDOT/W.P.
PROJECT NO. 7555-6
SUBJECT DRY POND w/ MARSH
SHEET NO. 3 OF 11
CALCULATED BY DPW DATE 9/27/99

$$Q_c = CA\sqrt{2gh}$$

$$C = 0.6$$

$$g = 32.2 \text{ ft/s}^2$$

$$\Delta h = \frac{50 - 48}{2} = 1.0'$$

$$0.69 \text{ CFS} = 0.6 A \sqrt{2(32.2)(1.0)}$$

$$A = 0.14 \text{ SF} = \pi r^2$$

$$r = 0.21' = 2.5''$$

$$\therefore d = 5'' \rightarrow \underline{\text{USE 4" DIAMETER ORIFICE}}$$

VERIFY EMERGENCY SPILLWAY

MAX EL FOR 100 YR STORM (ROUTED) = 56.42 (SEE SUMMARY REPORT, PG 7)

Q_{100} @ EL 56.42 = 243 CFS ± (SEE RESERVOIR RPT No. 1 REVISED POND, PG 9-11)

TRY 2' DEEP; 1:1 SS; 5.5% SLOPE; TRAPEZOIDAL SECTION

USE VDOT FIG 2.8.38

depth < 1.0' ∴ OK

MARSH SIZING

$$\text{MIN RQD VOLUME} = \left[\frac{(R_m)(R_v)}{12} \right] (DA) \text{ AC-FT}$$

$$R_m = 0.45'' (\% \text{ MEAN STORM})$$

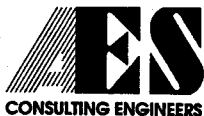
$$R_v = 0.05 + 0.009 (\% \text{ IMP})$$

$$DA = 47 \text{ AC}$$

$$\% \text{ IMP} = 31.0 (\text{FROM PAGE 1})$$

$$\underline{\text{RQD } V = 25,259 \text{ CF}}$$

$$\underline{\text{PROVIDED } V = 27,056 \text{ CF}}$$



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PROJECT VDOT / W.P.
PROJECT NO. 7555-6
SUBJECT DRY POND W/ MARSH
SHEET NO. 4 OF 11
CALCULATED BY DPW DATE 9/27/99

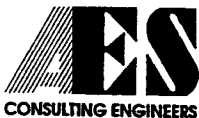
MIN. ROD SURFACE AREA = 2% (DA)

DA = 47 AC

∴ AREA ROD = 40,946 SF

AREA AVAILABLE AT EL 48 = 27,056 SF

* JCC LETTER DATED 8/23/99 ACCEPTS LESSER SURFACE
AREA W/ GREATER STORAGE PROVISION ∴ OK



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PROJECT WILLIAMSBURG PLANTATION
PROJECT NO. 7555-6
SUBJECT DRY POND W/ MARSH DESIGN
SHEET NO. X 5 OF X 11
CALCULATED BY DPLW DATE 2/4/99

FLOW ATTENUATION CALCS

PREDEVELOPMENT:

W.P. AREA = 21.09 AC

WOODED/GRASSED \rightarrow CN=73

199 AREA = 27.30 AC

AVG. GRASSED \rightarrow CN=71
(PER MMM CALCS)

$$CN = \frac{(21.09)(73) + (27.30 - 1.43)(71)}{47} = 71.8 \Rightarrow \underline{CN=72 \text{ PRE-DEV}}$$

POSTDEVELOPMENT:

W.P. AREA

BLDGs/SW \rightarrow 6.05 AC CN=98

ROADS \rightarrow 3.79 AC CN=98

OPEN \rightarrow 11.25 AC CN=74

$$CN = \frac{(6.05)(98) + (3.79)(98) + (11.25)(74)}{21.09} = 85.2$$

199 AREA

ROADS \rightarrow 6.05 AC CN=98

OPEN \rightarrow 19.82 AC CN=74

$\rightarrow 27.3 - 1.43 - 6.05$

$$CN = \frac{(6.05)(98) + (19.82)(74)}{25.87} = 79.6$$

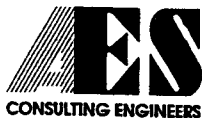
* NOTE \rightarrow TOTAL DA #'S
ARE NOT = 47 b/c
ROUNDING; SEE PAGE 1

$$CN = \frac{(21.09)(85.2) + (25.87)(79.6)}{47} = 82$$

$\Rightarrow \underline{CN=82 \text{ POST-DEV}}$

(NO REVISIONS 9/99)

SEE PG 7/11 FOR DISCHARGES



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PROJECT WILLIAMSBURG PLANTATION
PROJECT NO. 7555-6
SUBJECT DEY POND w/ MARSH DESIGN
SHEET NO. X 6 OF X 11
CALCULATED BY DPW DATE 2/22/99

INLET PIPE FOR W.P. AREA

A DROP-INLET (DI-7 TYPE) AND PIPE ARE INCLUDED FOR THE CONVEYANCE OF DRAINAGE FROM W.P. THE INLET HAS BEEN LOCATED SUCH THAT THE FUTURE STORM SEWER SYSTEM OF INDIAN FIELDS WAY MAY BE CONNECTED.

THE BARREL HAS BEEN SIZED FOR THE TOTAL CONTRIBUTING W.P. AREA AS A CONSERVATIVE MEASURE.

TOTAL W.P. DA = 21.09 AC (SEE SHEET 1 OF CALCS)

Q₁₀ POST FOR THIS AREA = 88.4 CFS (SEE SUMMARY REPORT #14)

ASSUME: FULL FLOWING PIPE (NEGL. FRICTION LOSS)
S = 0.015 FT/FT

$$Q = \frac{0.463}{n} d^{8/3} S^{1/2} \quad (\text{MANNING / CHEZY FORMULAS FOR FULL FLOW})$$

$$88.4 = \frac{0.463}{0.013} d^{8/3} (0.015)^{1/2}$$

$$d = 3.09' \therefore \text{USE } 36" \phi \quad \checkmark$$

DI-7 RQD DEPTH FOR PRECAST w/ 36" ϕ \rightarrow 4'-8" OR 4.67'
(FROM VDOT STANDARD 104.22)

$$\therefore \text{TOP} = 53.50$$

$$\text{INV} = 48.80$$

$$4.7' > 4.67' \quad \text{OK}$$

(NO REVISIONS 9/99)

Hydrograph Summary Report

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Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Return period (yrs)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	51.8	1	733	225,039	2	—	—	—	2 YEAR PRE-DEV
2	SCS Runoff	116.2	1	733	482,602	10	—	—	—	10 YEAR PRE-DEV
3	SCS Runoff	151.1	1	732	624,143	25	—	—	—	25 YEAR PRE-DEV
4	SCS Runoff	216.2	1	732	891,574	100	—	—	—	100 YEAR PRE-DEV
5	SCS Runoff	98.1	5	725	346,869	2	—	—	—	2 YEAR POST-DEV
6	SCS Runoff	183.5	5	725	648,925	10	—	—	—	10 YEAR POST-DEV
7	SCS Runoff	227.0	5	725	806,819	25	—	—	—	25 YEAR POST-DEV
8	SCS Runoff	305.6	5	725	1,097,217	100	—	—	—	100 YEAR POST DEV
9	Reservoir	18.5	5	755	341,056	2	5	52.89	187,468	2 YR POST DEV ROUT
10	Reservoir	114.3	5	740	643,103	10	6	54.81	263,700	10 YR POST DEV ROU
11	Reservoir	148.9	5	735	800,994	25	7	55.53	295,605	25 YR POST DEV ROU
12	Reservoir	242.6	5	735	1,091,386	100	8	56.42	336,376	100 YR POST DEV RO

<u>FLOW ATTENUATION</u>		
STORM (YR)	PRE (CFS)	POST (ROUTED) (CFS)
2	51.8	18.5
10	116.2	114.3
25	151.1	148.9
100	216.2	242.6

Proj. file: 755506DRYR.GPW

IDF file: Jcc.idf

Run date: 09-28-1999

8/11

English

Pond storage is based on known contour areas

Stage ft	Elevation ft	Contour area sqft	Incr. Storage cuft	Total storage cuft
0.00	47.00	23,197	0	0
2.00	49.00	30,915	54,112	54,112
4.00	51.00	34,212	65,127	119,239
6.00	53.00	37,879	72,091	191,330
8.00	55.00	42,078	79,957	271,287
10.00	57.00	49,620	91,698	362,985

Weir Structures

	[A]	[B]	[C]	[D]
Rise in	= 0.0	0.0	0.0	0.0
Span in	= 0.0	0.0	0.0	0.0
No. Barrels	= 0	0	0	0
Invert El. ft	= 0.00	0.00	0.00	0.00
Length ft	= 0.0	0.0	0.0	0.0
Slope %	= 0.00	0.00	0.00	0.00
N-Value	= .000	.000	.000	.000
Orif. Coeff.	= 0.00	0.00	0.00	0.00
Multi-Stage	= ----	No	No	No

	[A]	[B]	[C]	[D]
Crest Len ft	= 0.0	0.0	0.0	0.0
Crest El. ft	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 0.00	0.00	0.00	0.00
Eqn. Exp.	= 0.00	0.00	0.00	0.00
Multi-Stage	= No	No	No	No

Tailwater Elevation = 0.00 ft

Note: All outflows have been analyzed under inlet and outlet control.

[illegible]

Reservoir Report

Page 1

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Reservoir No. 1 - REVISED POND SEPT 99

English

Pond Data

Pond storage is based on known contour areas

Stage / Storage Table

Stage ft	Elevation ft	Contour area sqft	Incr. Storage cuft	Total storage cuft
0.00	44.00	00	0	0
1.00	45.00	12	6	6
2.00	46.00	12	12	18
2.99	46.99	12	12	30
3.00	47.00	23,197	116	146
5.00	49.00	30,915	54,112	54,258
7.00	51.00	34,212	65,127	119,385
9.00	53.00	37,879	72,091	191,476
11.00	55.00	42,078	79,957	271,433
13.00	57.00	49,620	91,698	363,131

Culvert / Orifice Structures

	[A]	[B]	[C]	[D]
Rise in	= 42.0	4.0	6.0	0.0
Span in	= 42.0	4.0	18.0	0.0
No. Barrels	= 1	1	3	0
Invert El. ft	= 44.14	48.00	50.00	0.00
Length ft	= 45.0	0.5	0.5	0.0
Slope %	= 0.42	0.00	0.00	0.00
N-Value	= .013	.013	.013	.000
Orif. Coeff.	= 0.60	0.60	0.60	0.00
Multi-Stage	= ---	Yes	Yes	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len ft	= 12.5	30.0	0.0	0.0
Crest El. ft	= 53.00	55.40	0.00	0.00
Weir Coeff.	= 3.00	3.00	0.00	0.00
Eqn. Exp.	= 1.50	1.50	0.00	0.00
Multi-Stage	= Yes	No	No	No

Tailwater Elevation = 0.00 ft

Stage / Storage / Discharge Table

Note: All outflows have been analyzed under inlet and outlet control.

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Discharge cfs
0.00	0	44.00	0.00	0.00	0.00	---	0.00	0.00	---	---	0.00
0.10	1	44.10	0.00	0.00	0.00	---	0.00	0.00	---	---	0.00
0.20	1	44.20	0.03	0.00	0.00	---	0.00	0.00	---	---	0.00
0.30	2	44.30	0.22	0.00	0.00	---	0.00	0.00	---	---	0.00
0.40	2	44.40	0.68	0.00	0.00	---	0.00	0.00	---	---	0.00
0.50	3	44.50	1.12	0.00	0.00	---	0.00	0.00	---	---	0.00
0.60	4	44.60	1.63	0.00	0.00	---	0.00	0.00	---	---	0.00
0.70	4	44.70	2.25	0.00	0.00	---	0.00	0.00	---	---	0.00
0.80	5	44.80	2.98	0.00	0.00	---	0.00	0.00	---	---	0.00
0.90	5	44.90	3.82	0.00	0.00	---	0.00	0.00	---	---	0.00
1.00	6	45.00	4.76	0.00	0.00	---	0.00	0.00	---	---	0.00

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Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Discharge cfs
1.10	7	45.10	5.80	0.00	0.00	---	0.00	0.00	---	---	0.00
1.20	8	45.20	6.35	0.00	0.00	---	0.00	0.00	---	---	0.00
1.30	10	45.30	7.51	0.00	0.00	---	0.00	0.00	---	---	0.00
1.40	11	45.40	8.12	0.00	0.00	---	0.00	0.00	---	---	0.00
1.50	12	45.50	9.37	0.00	0.00	---	0.00	0.00	---	---	0.00
1.60	13	45.60	10.01	0.00	0.00	---	0.00	0.00	---	---	0.00
1.70	14	45.70	11.31	0.00	0.00	---	0.00	0.00	---	---	0.00
1.80	16	45.80	11.98	0.00	0.00	---	0.00	0.00	---	---	0.00
1.90	17	45.90	13.30	0.00	0.00	---	0.00	0.00	---	---	0.00
2.00	18	46.00	13.96	0.00	0.00	---	0.00	0.00	---	---	0.00
2.10	19	46.10	15.27	0.00	0.00	---	0.00	0.00	---	---	0.00
2.20	20	46.20	15.91	0.00	0.00	---	0.00	0.00	---	---	0.00
2.30	22	46.30	16.54	0.00	0.00	---	0.00	0.00	---	---	0.00
2.40	23	46.40	17.76	0.00	0.00	---	0.00	0.00	---	---	0.00
2.49	24	46.49	18.35	0.00	0.00	---	0.00	0.00	---	---	0.00
2.59	25	46.59	19.48	0.00	0.00	---	0.00	0.00	---	---	0.00
2.69	26	46.69	20.52	0.00	0.00	---	0.00	0.00	---	---	0.00
2.79	28	46.79	21.00	0.00	0.00	---	0.00	0.00	---	---	0.00
2.89	29	46.89	21.90	0.00	0.00	---	0.00	0.00	---	---	0.00
2.99	30	46.99	22.69	0.00	0.00	---	0.00	0.00	---	---	0.00
2.99	42	46.99	48.79	0.00	0.00	---	0.00	0.00	---	---	0.00
2.99	53	46.99	48.80	0.00	0.00	---	0.00	0.00	---	---	0.00
2.99	65	46.99	48.81	0.00	0.00	---	0.00	0.00	---	---	0.00
2.99	76	46.99	48.82	0.00	0.00	---	0.00	0.00	---	---	0.00
2.99	88	46.99	48.83	0.00	0.00	---	0.00	0.00	---	---	0.00
3.00	100	47.00	48.84	0.00	0.00	---	0.00	0.00	---	---	0.00
3.00	111	47.00	48.85	0.00	0.00	---	0.00	0.00	---	---	0.00
3.00	123	47.00	48.85	0.00	0.00	---	0.00	0.00	---	---	0.00
3.00	134	47.00	48.86	0.00	0.00	---	0.00	0.00	---	---	0.00
3.00	146	47.00	48.87	0.00	0.00	---	0.00	0.00	---	---	0.00
3.20	5,557	47.20	53.42	0.00	0.00	---	0.00	0.00	---	---	0.00
3.40	10,968	47.40	57.56	0.00	0.00	---	0.00	0.00	---	---	0.00
3.60	16,380	47.60	60.83	0.00	0.00	---	0.00	0.00	---	---	0.00
3.80	21,791	47.80	64.02	0.00	0.00	---	0.00	0.00	---	---	0.00
4.00	27,202	48.00	67.28	0.00	0.00	---	0.00	0.00	---	---	0.00
4.20	32,613	48.20	70.40	0.09	0.00	---	0.00	0.00	---	---	0.09
4.40	38,024	48.40	73.38	0.14	0.00	---	0.00	0.00	---	---	0.14
4.60	43,436	48.60	76.25	0.28	0.00	---	0.00	0.00	---	---	0.28
4.80	48,847	48.80	79.02	0.33	0.00	---	0.00	0.00	---	---	0.33
5.00	54,258	49.00	81.69	0.38	0.00	---	0.00	0.00	---	---	0.38
5.20	60,771	49.20	84.27	0.43	0.00	---	0.00	0.00	---	---	0.43
5.40	67,283	49.40	86.78	0.47	0.00	---	0.00	0.00	---	---	0.47
5.60	73,796	49.60	89.22	0.50	0.00	---	0.00	0.00	---	---	0.50
5.80	80,309	49.80	91.59	0.54	0.00	---	0.00	0.00	---	---	0.54
6.00	86,822	50.00	92.82	0.57	0.00	---	0.00	0.00	---	---	0.57
6.20	93,334	50.20	96.16	0.60	1.37	---	0.00	0.00	---	---	1.97
6.40	99,847	50.40	98.37	0.63	3.88	---	0.00	0.00	---	---	4.50
6.60	106,360	50.60	100.53	0.66	4.63	---	0.00	0.00	---	---	5.28
6.80	112,872	50.80	102.64	0.68	8.01	---	0.00	0.00	---	---	8.70
7.00	119,385	51.00	104.71	0.71	9.38	---	0.00	0.00	---	---	10.09
7.20	126,594	51.20	106.74	0.73	10.56	---	0.00	0.00	---	---	11.29
7.40	133,803	51.40	108.73	0.76	11.62	---	0.00	0.00	---	---	12.37
7.60	141,012	51.60	110.68	0.78	12.59	---	0.00	0.00	---	---	13.37

Continues on next page...

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Discharge cfs
7.80	148,221	51.80	112.61	0.80	13.49	—	0.00	0.00	—	—	14.29
8.00	155,430	52.00	114.50	0.82	14.33	—	0.00	0.00	—	—	15.15
8.20	162,640	52.20	116.35	0.84	15.13	—	0.00	0.00	—	—	15.97
8.40	169,849	52.40	118.18	0.86	15.89	—	0.00	0.00	—	—	16.75
8.60	177,058	52.60	119.99	0.88	16.61	—	0.00	0.00	—	—	17.49
8.80	184,267	52.80	121.76	0.90	17.30	—	0.00	0.00	—	—	18.20
9.00	191,476	53.00	123.51	0.92	17.97	—	0.00	0.00	—	—	18.89
9.20	199,472	53.20	125.23	0.94	18.61	—	3.35	0.00	—	—	22.90
9.40	207,467	53.40	126.94	0.96	19.23	—	9.49	0.00	—	—	29.68
9.60	215,463	53.60	128.62	0.98	19.83	—	17.43	0.00	—	—	38.24
9.80	223,459	53.80	130.27	1.00	20.41	—	26.83	0.00	—	—	48.24
10.00	231,455	54.00	131.91	1.01	20.98	—	37.50	0.00	—	—	59.49
10.20	239,450	54.20	133.53	1.03	21.53	—	49.30	0.00	—	—	71.86
10.40	247,446	54.40	135.12	1.04	22.07	—	62.12	0.00	—	—	85.23
10.60	255,442	54.60	136.70	0.97	22.60	—	75.90	0.00	—	—	99.46
10.80	263,437	54.80	138.26	0.87	22.46	—	90.56	0.00	—	—	113.89
11.00	271,433	55.00	139.81	0.74	18.96	—	106.07	0.00	—	—	125.76
11.20	280,603	55.20	141.33	0.58	15.08	—	122.37	0.00	—	—	138.03
11.40	289,773	55.40	142.84	0.33	8.59	—	139.43	0.00	—	—	142.84
11.60	298,942	55.60	144.34	0.00	0.00	—	157.21	8.05	—	—	152.39
11.80	308,112	55.80	145.82	0.00	0.00	—	175.70	22.77	—	—	168.58
12.00	317,282	56.00	147.28	0.00	0.00	—	194.86	41.83	—	—	189.11
12.20	326,452	56.20	148.73	0.00	0.00	—	214.66	64.40	—	—	213.13
12.40	335,622	56.40	150.16	0.00	0.00	—	235.10	90.00	—	—	240.17
12.60	344,792	56.60	151.59	0.00	0.00	—	256.15	118.31	—	—	269.90
12.80	353,961	56.80	153.00	0.00	0.00	—	277.78	149.09	—	—	302.08
13.00	363,131	57.00	154.39	0.00	0.00	—	300.00	182.15	—	—	336.54

...End

HYDROGRAPH REPORTS

Hydrograph Report

Page 1

English

Hyd. No. 1

2 YEAR PRE-DEV

Hydrograph type = SCS Runoff
Storm frequency = 2 yrs
Drainage area = 47.00 ac
Basin Slope = 3.5 %
Tc method = LAG
Total precip. = 3.80 in
Storm duration = 24 hrs

Peak discharge = 51.79 cfs
Time interval = 1 min
Curve number = 72
Hydraulic length = 1600 ft
Time of conc. (Tc) = 31.3 min
Distribution = Type II
Shape factor = 484

Total Volume = 225,039 cuft

Hydrograph Discharge Table

Time -- Outflow (hrs cfs)	Time -- Outflow (hrs cfs)
11.78 5.34	12.85 10.55
11.82 6.96	12.88 10.12
11.85 9.17	12.92 9.72
11.88 12.16	12.95 9.36
11.92 16.13	12.98 9.02
11.95 20.87	13.02 8.72
11.98 26.03	13.05 8.44
12.02 31.19	13.08 8.18
12.05 36.16	13.12 7.95
12.08 40.82	13.15 7.73
12.12 44.99	13.18 7.54
12.15 48.43	13.22 7.36
12.18 50.82	13.25 7.20
12.22 51.79 <<	13.28 7.04
12.25 51.15	13.32 6.90
12.28 49.42	13.35 6.77
12.32 47.11	13.38 6.64
12.35 44.63	13.42 6.52
12.38 42.03	13.45 6.40
12.42 39.31	13.48 6.29
12.45 36.51	13.52 6.17
12.48 33.62	13.55 6.07
12.52 30.69	13.58 5.96
12.55 27.73	13.62 5.86
12.58 24.79	13.65 5.77
12.62 21.90	13.68 5.67
12.65 19.15	13.72 5.58
12.68 16.63	13.75 5.49
12.72 14.47	13.78 5.41
12.75 12.81	13.82 5.32
12.78 11.73	13.85 5.24
12.82 11.04	

...End

Hydrograph Report

Page 1

English

Hyd. No. 9

2 YR POST DEV ROUTED

Hydrograph type = Reservoir
Storm frequency = 2 yrs
Inflow hyd. No. = 5
Max. Elevation = 52.89 ft

Peak discharge = 18.51 cfs
Time interval = 5 min
Reservoir name = REVISED POND SE
Max. Storage = 187,468 cuft

Storage Indication method used.

Total Volume = 341,056 cuft

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Outflow cfs
12.17	91.12	51.58	110.44	0.78	12.47	---	---	---	---	---	13.24
12.33	54.72	52.53	119.37	0.88	16.36	---	---	---	---	---	17.24
12.50	23.67	52.87	122.38	0.91	17.54	---	---	---	---	---	18.45
12.67	15.38	52.87	122.39	0.91	17.54	---	---	---	---	---	18.45
12.83	12.25	52.80	121.72	0.90	17.28	---	---	---	---	---	18.19
13.00	10.46	52.68	120.73	0.89	16.90	---	---	---	---	---	17.79
13.17	9.32	52.56	119.58	0.88	16.45	---	---	---	---	---	17.33
13.33	8.42	52.42	118.35	0.87	15.95	---	---	---	---	---	16.82
13.50	7.70	52.28	117.06	0.85	15.42	---	---	---	---	---	16.27
13.67	7.08	52.13	115.74	0.84	14.87	---	---	---	---	---	15.70
13.83	6.53	51.99	114.41	0.82	14.29	---	---	---	---	---	15.11
14.00	6.04	51.85	113.07	0.81	13.69	---	---	---	---	---	14.50
14.17	5.61	51.71	111.74	0.79	13.08	---	---	---	---	---	13.87
14.33	5.30	51.57	110.43	0.78	12.46	---	---	---	---	---	13.24
14.50	5.09	51.45	109.18	0.76	11.84	---	---	---	---	---	12.60
14.67	4.93	51.32	107.98	0.75	11.22	---	---	---	---	---	11.97
14.83	4.77	51.21	106.85	0.73	10.62	---	---	---	---	---	11.35
15.00	4.62	51.11	105.78	0.72	10.01	---	---	---	---	---	10.73
15.17	4.45	51.01	104.79	0.71	9.43	---	---	---	---	---	10.14
15.33	4.29	50.91	103.76	0.70	8.76	---	---	---	---	---	9.45
15.50	4.13	50.82	102.83	0.68	8.14	---	---	---	---	---	8.82
15.67	3.97	50.74	102.01	0.67	7.00	---	---	---	---	---	7.68
15.83	3.80	50.68	101.37	0.67	5.99	---	---	---	---	---	6.65
16.00	3.64	50.63	100.88	0.66	5.20	---	---	---	---	---	5.86
16.17	3.48	50.60	100.49	0.65	4.62	---	---	---	---	---	5.27
16.33	3.37	50.56	100.14	0.65	4.49	---	---	---	---	---	5.14
16.50	3.30	50.53	99.79	0.65	4.37	---	---	---	---	---	5.02
16.67	3.24	50.50	99.46	0.64	4.25	---	---	---	---	---	4.90
16.83	3.18	50.47	99.13	0.64	4.14	---	---	---	---	---	4.78
17.00	3.12	50.44	98.82	0.63	4.03	---	---	---	---	---	4.67
17.17	3.06	50.41	98.52	0.63	3.93	---	---	---	---	---	4.56
17.33	3.01	50.39	98.23	0.63	3.72	---	---	---	---	---	4.34
17.50	2.95	50.36	97.98	0.62	3.43	---	---	---	---	---	4.06
17.67	2.89	50.35	97.77	0.62	3.20	---	---	---	---	---	3.82
17.83	2.83	50.33	97.60	0.62	3.00	---	---	---	---	---	3.62
18.00	2.77	50.32	97.45	0.62	2.83	---	---	---	---	---	3.45

Continues on next page...

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Outflow cfs
18.17	2.71	50.31	97.32	0.61	2.69	----	----	----	----	----	3.30
18.33	2.65	50.29	97.21	0.61	2.56	----	----	----	----	----	3.17
18.50	2.59	50.29	97.11	0.61	2.44	----	----	----	----	----	3.06
18.67	2.53	50.28	97.02	0.61	2.34	----	----	----	----	----	2.95
18.83	2.47	50.27	96.94	0.61	2.25	----	----	----	----	----	2.86
19.00	2.41	50.26	96.86	0.61	2.16	----	----	----	----	----	2.77
19.17	2.35	50.26	96.79	0.61	2.08	----	----	----	----	----	2.69
19.33	2.29	50.25	96.72	0.61	2.01	----	----	----	----	----	2.61
19.50	2.23	50.24	96.66	0.61	1.93	----	----	----	----	----	2.54
19.67	2.17	50.24	96.60	0.60	1.86	----	----	----	----	----	2.47
19.83	2.11	50.23	96.54	0.60	1.80	----	----	----	----	----	2.40
20.00	2.05	50.23	96.48	0.60	1.73	----	----	----	----	----	2.33
20.17	1.99	50.22	96.42	0.60	1.66	----	----	----	----	----	2.27
20.33	1.95	50.22	96.37	0.60	1.60	----	----	----	----	----	2.21
20.50	1.94	50.21	96.32	0.60	1.55	----	----	----	----	----	2.15
20.67	1.92	50.21	96.28	0.60	1.50	----	----	----	----	----	2.10
20.83	1.91	50.21	96.25	0.60	1.47	----	----	----	----	----	2.07
21.00	1.90	50.20	96.22	0.60	1.43	----	----	----	----	----	2.03
21.17	1.89	50.20	96.19	0.60	1.40	----	----	----	----	----	2.00
21.33	1.88	50.20	96.17	0.60	1.38	----	----	----	----	----	1.98
21.50	1.87	50.20	96.14	0.60	1.36	----	----	----	----	----	1.96
21.67	1.85	50.20	96.11	0.60	1.35	----	----	----	----	----	1.95
21.83	1.84	50.20	96.09	0.60	1.34	----	----	----	----	----	1.94
22.00	1.83	50.19	96.06	0.60	1.33	----	----	----	----	----	1.93
22.17	1.82	50.19	96.03	0.60	1.32	----	----	----	----	----	1.91
22.33	1.81	50.19	96.00	0.60	1.30	----	----	----	----	----	1.90
22.50	1.80	50.19	95.97	0.60	1.29	----	----	----	----	----	1.89
22.67	1.78	50.19	95.94	0.60	1.28	----	----	----	----	----	1.88
22.83	1.77	50.19	95.91	0.60	1.27	----	----	----	----	----	1.87
23.00	1.76	50.18	95.88	0.60	1.26	----	----	----	----	----	1.85

...End

Hydrograph Report

Page 1

English

Hyd. No. 2

10 YEAR PRE-DEV

Hydrograph type = SCS Runoff
Storm frequency = 10 yrs
Drainage area = 47.00 ac
Basin Slope = 3.5 %
Tc method = LAG
Total precip. = 5.80 in
Storm duration = 24 hrs

Peak discharge = 116.17 cfs
Time interval = 1 min
Curve number = 72
Hydraulic length = 1600 ft
Time of conc. (Tc) = 31.3 min
Distribution = Type II
Shape factor = 484

Total Volume = 482,602 cuft

Hydrograph Discharge Table

Time -- Outflow (hrs cfs)	Time -- Outflow (hrs cfs)
11.72 12.34	12.78 23.01
11.75 14.76	12.82 21.60
11.78 17.91	12.85 20.62
11.82 22.10	12.88 19.75
11.85 27.61	12.92 18.94
11.88 34.76	12.95 18.21
11.92 43.89	12.98 17.53
11.95 54.46	13.02 16.92
11.98 65.67	13.05 16.36
12.02 76.67	13.08 15.84
12.05 87.02	13.12 15.37
12.08 96.51	13.15 14.95
12.12 104.75	13.18 14.56
12.15 111.18	13.22 14.20
12.18 115.22	13.25 13.87
12.22 116.17 <<	13.28 13.57
12.25 113.74	13.32 13.29
12.28 109.10	13.35 13.02
12.32 103.28	13.38 12.76
12.35 97.16	13.42 12.52
12.38 90.82	13.45 12.28
12.42 84.30	13.48 12.05
12.45 77.65	13.52 11.83
12.48 70.92	13.55 11.62
12.52 64.17	
12.55 57.47	
12.58 50.89	...End
12.62 44.54	
12.65 38.56	
12.68 33.19	
12.72 28.65	
12.75 25.22	

Hydrograph Report

Page 1

English

Hyd. No. 6

10 YEAR POST-DEV

Hydrograph type = SCS Runoff
Storm frequency = 10 yrs
Drainage area = 47.00 ac
Basin Slope = 3.7 %
Tc method = LAG
Total precip. = 5.80 in
Storm duration = 24 hrs

Peak discharge = 183.47 cfs
Time interval = 5 min
Curve number = 82
Hydraulic length = 1600 ft
Time of conc. (Tc) = 22.6 min
Distribution = Type II
Shape factor = 484

Total Volume = 648,925 cuft

Hydrograph Discharge Table

Time -- Outflow (hrs cfs)

11.67	24.38
11.83	66.13
12.00	158.68
12.17	167.91
12.33	98.39
12.50	41.30
12.67	26.62
12.83	21.11

...End

Hydrograph Report

Page 1

English

Hyd. No. 10

10 YR POST DEV ROUTED

Hydrograph type = Reservoir
Storm frequency = 10 yrs
Inflow hyd. No. = 6
Max. Elevation = 54.81 ft

Peak discharge = 114.28 cfs
Time interval = 5 min
Reservoir name = REVISED POND SE
Max. Storage = 263,700 cuft

Storage Indication method used.

Total Volume = 643,103 cuft

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Outflow cfs
12.00	158.68	52.41	118.26	0.87	15.92	---	---	---	---	---	16.78
12.17	167.91	54.41	135.22	1.03	22.10	---	62.92	---	---	---	86.06
12.33	98.39	54.81 <<	138.31	0.87	22.35	---	91.07	---	---	---	114.28 <<
12.50	41.30	54.34	134.64	1.04	21.91	---	58.22	---	---	---	81.17
12.67	26.62	53.85	130.68	1.00	20.55	---	29.48	---	---	---	51.04
12.83	21.11	53.56	128.26	0.98	19.70	---	15.74	---	---	---	36.42
13.00	17.98	53.37	126.65	0.96	19.12	---	8.44	---	---	---	28.52
13.17	15.97	53.23	125.48	0.95	18.70	---	4.22	---	---	---	23.87
13.33	14.40	53.12	124.54	0.93	18.35	---	1.99	---	---	---	21.28
13.50	13.15	53.02	123.69	0.93	18.03	---	0.35	---	---	---	19.31
13.67	12.07	52.92	122.80	0.92	17.70	---	---	---	---	---	18.61
13.83	11.12	52.81	121.81	0.90	17.32	---	---	---	---	---	18.22
14.00	10.28	52.68	120.73	0.89	16.90	---	---	---	---	---	17.79
14.17	9.53	52.56	119.59	0.88	16.45	---	---	---	---	---	17.33
14.33	8.99	52.43	118.41	0.87	15.98	---	---	---	---	---	16.84
14.50	8.63	52.30	117.23	0.85	15.49	---	---	---	---	---	16.34
14.67	8.35	52.17	116.07	0.84	15.01	---	---	---	---	---	15.85
14.83	8.08	52.05	114.93	0.83	14.52	---	---	---	---	---	15.34
15.00	7.80	51.93	113.81	0.81	14.03	---	---	---	---	---	14.84
15.17	7.52	51.81	112.72	0.80	13.54	---	---	---	---	---	14.34
15.33	7.25	51.70	111.65	0.79	13.04	---	---	---	---	---	13.83
15.50	6.97	51.59	110.61	0.78	12.55	---	---	---	---	---	13.33
15.67	6.69	51.49	109.60	0.77	12.05	---	---	---	---	---	12.81
15.83	6.40	51.39	108.62	0.75	11.56	---	---	---	---	---	12.31
16.00	6.12	51.29	107.66	0.74	11.05	---	---	---	---	---	11.79

...End

Hydrograph Report

Page 1

English

Hyd. No. 3

25 YEAR PRE-DEV

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Drainage area = 47.00 ac
Basin Slope = 3.5 %
Tc method = LAG
Total precip. = 6.80 in
Storm duration = 24 hrs

Peak discharge = 151.09 cfs
Time interval = 1 min
Curve number = 72
Hydraulic length = 1600 ft
Time of conc. (Tc) = 31.3 min
Distribution = Type II
Shape factor = 484

Total Volume = 624,143 cuft

Hydrograph Discharge Table

Time -- Outflow (hrs) cfs)	Time -- Outflow (hrs) cfs)
11.68 15.20	12.75 31.64
11.72 17.72	12.78 28.84
11.75 21.01	12.82 27.06
11.78 25.28	12.85 25.82
11.82 30.91	12.88 24.72
11.85 38.25	12.92 23.70
11.88 47.69	12.95 22.77
11.92 59.63	12.98 21.92
11.95 73.32	13.02 21.14
11.98 87.77	13.05 20.43
12.02 101.86	13.08 19.78
12.05 115.04	13.12 19.19
12.08 127.05	13.15 18.66
12.12 137.38	13.18 18.16
12.15 145.32	13.22 17.71
12.18 150.12	13.25 17.30
12.22 150.95	13.28 16.92
12.25 147.47	13.32 16.56
12.28 141.18	13.35 16.23
12.32 133.43	13.38 15.90
12.35 125.28	13.42 15.60
12.38 116.88	13.45 15.30
12.42 108.28	
12.45 99.52	
12.48 90.69	...End
12.52 81.86	
12.55 73.13	
12.58 64.59	
12.62 56.38	
12.65 48.69	
12.68 41.80	
12.72 36.00	

Hydrograph Report

Page 1

English

Hyd. No. 7

25 YEAR POST-DEVELOPMENT

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Drainage area = 47.00 ac
Basin Slope = 3.7 %
Tc method = LAG
Total precip. = 6.80 in
Storm duration = 24 hrs

Peak discharge = 227.00 cfs
Time interval = 5 min
Curve number = 82
Hydraulic length = 1600 ft
Time of conc. (Tc) = 22.6 min
Distribution = Type II
Shape factor = 484

Total Volume = 806,819 cuft

Hydrograph Discharge Table

Time -- Outflow (hrs cfs)

11.67	31.60
11.83	84.05
12.00	197.49
12.17	206.89
12.33	120.39
12.50	50.11
12.67	32.22
12.83	25.53

...End

Hydrograph Report

Page 1

English

Hyd. No. 4

100 YEAR PRE-DEV

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Drainage area = 47.00 ac
Basin Slope = 3.5 %
Tc method = LAG
Total precip. = 8.60 in
Storm duration = 24 hrs

Peak discharge = 216.18 cfs
Time interval = 1 min
Curve number = 72
Hydraulic length = 1600 ft
Time of conc. (Tc) = 31.3 min
Distribution = Type II
Shape factor = 484

Total Volume = 891,574 cuft

Hydrograph Discharge Table

Time -- Outflow (hrs cfs)	Time -- Outflow (hrs cfs)
11.67 22.91	12.73 46.05
11.70 26.26	12.77 41.16
11.73 30.63	12.80 38.05
11.77 36.25	12.83 36.07
11.80 43.56	12.87 34.47
11.83 53.08	12.90 33.01
11.87 65.29	12.93 31.67
11.90 80.67	12.97 30.44
11.93 99.25	13.00 29.32
11.97 119.40	13.03 28.30
12.00 139.66	13.07 27.36
12.03 158.78	13.10 26.51
12.07 176.32	13.13 25.74
12.10 191.78	13.17 25.03
12.13 204.25	13.20 24.38
12.17 212.74	13.23 23.79
12.20 216.18 <<	13.27 23.24
12.23 213.44	13.30 22.74
12.27 205.80	13.33 22.26
12.30 195.11	13.37 21.81
12.33 183.35	
12.37 171.23	
12.40 158.81	...End
12.43 146.18	
12.47 133.43	
12.50 120.69	
12.53 108.07	
12.57 95.71	
12.60 83.77	
12.63 72.46	
12.67 62.14	
12.70 53.19	

Hydrograph Report

Page 1

English

Hyd. No. 8

100 YEAR POST DEVELOPMENT

Hydrograph type	= SCS Runoff	Peak discharge	= 305.57 cfs
Storm frequency	= 100 yrs	Time interval	= 5 min
Drainage area	= 47.00 ac	Curve number	= 82
Basin Slope	= 3.7 %	Hydraulic length	= 1600 ft
Tc method	= LAG	Time of conc. (Tc)	= 22.6 min
Total precip.	= 8.60 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Total Volume = 1,097,217 cuft

Hydrograph Discharge Table

Time -- Outflow
(hrs cfs)

11.58	31.93
11.75	70.96
11.92	192.69
12.08	305.57 <<
12.25	217.93
12.42	106.81
12.58	48.38
12.75	37.23
12.92	30.59

...End

Hydrograph Report

Page 1

English

Hyd. No. 12

100 YR POST DEV ROUTED

Hydrograph type = Reservoir
Storm frequency = 100 yrs
Inflow hyd. No. = 8
Max. Elevation = 56.42 ft

Peak discharge = 242.61 cfs
Time interval = 5 min
Reservoir name = REVISED POND SE
Max. Storage = 336,376 cuft

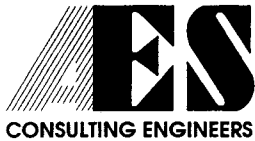
Storage Indication method used.

Total Volume = 1,091,386 cuft

Hydrograph Discharge Table

Time (hrs)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Outflow cfs
12.00	267.77	54.75	137.90	0.89	22.49	---	87.16	---	---	---	110.54
12.17	277.12	56.36	149.86	---	---	---	230.76	84.56	---	---	234.42
12.33	159.88	56.17	148.53	---	---	---	211.93	61.28	---	---	209.81
12.50	65.88	55.35	142.49	0.39	10.11	---	135.44	---	---	---	141.72
12.67	42.24	54.43	135.38	1.03	22.15	---	64.32	---	---	---	87.50
12.83	33.43	53.94	131.44	1.01	20.82	---	34.42	---	---	---	56.24
13.00	28.42	53.68	129.25	0.99	20.05	---	21.01	---	---	---	42.04
13.17	25.21	53.51	127.85	0.97	19.56	---	13.82	---	---	---	34.35
13.33	22.70	53.39	126.86	0.96	19.20	---	9.23	---	---	---	29.39
13.50	20.71	53.30	126.08	0.95	18.92	---	6.41	---	---	---	26.28

...End



5248 Olde Towne Road • Suite 1 • Williamsburg, Virginia 23188
(757) 253-0040 • Fax (757) 220-8994 • E-mail aes@aesva.com

June 14, 1999

Mr. Darryl E. Cook, Environmental Director
James City County
101-E Mounts Bay Road
Williamsburg, Virginia 23185



RE: VDOT/ WILLIAMSBURG PLANTATION COMBINED DRY POND

Dear Mr. Cook:

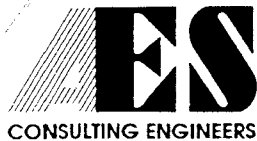
Please find enclosed three sets of revised 11"x17" plans for the above mentioned project. During a review of these plans, an error was found in the top elevation call for the DI outlet structure. The top elevation is to be **51.90**, not 51.790. The details of the outlet structure appearing on sheet two are correct.

Should you have any questions regarding these drawings or the pond design, please contact me at 253-0040. I would be happy to discuss your concerns.

Sincerely,
AES Consulting Engineers

A handwritten signature in black ink, reading 'Deirdre P. Wells'.

Deirdre P. Wells
Project Engineer



5248 Olde Towne Road • Suite 1 • Williamsburg, Virginia 23188
(757) 253-0040 • Fax (757) 220-8994 • E-mail aes@aesva.com

FILE COPY

June 3, 1999

Mr. O. Marvin Sowers, Director of Planning
James City County
P.O. Box 8784
Williamsburg, Virginia 23187-8784

**RE: Joint Williamsburg Plantation and VDOT Stormwater Management Pond
AES Project No. 7555-6**

Dear Mr. Sowers:

Please find enclosed 3 sets of plans and calculations for the joint stormwater management facility for the VDOT Route 199 and the Williamsburg Plantation projects. We are sending copies of this "final" plan to your office for County review (and approval) to insure that this facility meets the County design requirements.

This facility is in the location shown on the approved Williamsburg Plantation as the Stormwater Management Pond for Phase III. The **proposed** combined facility has come about as part of a **tentative** agreement between VDOT and Williamsburg Plantation necessitated by VDOT's need for Stormwater Management facilities in this area for the Route 199 project. This facility is located on the land originally condemned by VDOT for the Route 199 project; however, the land is now **proposed** to remain under the ownership of Williamsburg Plantation with an easement granted to VDOT.

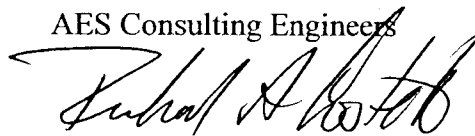
The joint facility has been designed as a pond with a shallow marsh bottom in order to fulfill the James City County requirements for a 9-point BMP facility. While the bottom of the pond is not depressed as per the normal shallow marsh design, wetland species have proliferated in the existing VDOT dry pond due to the high water table at the site. With that knowledge in mind, in our enlargement of the existing pond we maintained the existing bottom elevations to insure continued growth of wetland species. Of course, this **proposed** pond fulfills the VDOT criteria for flow attenuation serving their primary road system and they have approved the attached plans. Several different design options were explored by AES to incorporate the existing outlet structure and, thus, retain the integrity of the structure. The attached design requires that the crest of the outlet structure be raised, a process which may be completed "in-place" and will not compromise its integrity.

The pond currently constructed at the site is a single use pond by VDOT on right-of-way they acquired by condemnation. This pond will remain as is until Williamsburg Plantation needs additional stormwater capacity for the future phases of their project. Then Williamsburg Plantation will reconstruct the pond per the attached plans under a permit granted by VDOT as part the overall agreement between VDOT and Williamsburg Plantation. The attached site plan indicates the location of the **proposed** stormwater management pond and shows the permanent easement that will be dedicated to VDOT as part of the overall agreement between VDOT and Williamsburg Plantation. This easement has been placed such that conflicts will be avoided with proposed buildings, roads, and parking lots associated with proposed Williamsburg Plantation development.

If there are specific questions related to the pond calculations, please contact Deirdre Wells at our office. If there are general questions on location, operation, or maintenance, please contact Richard Costello.

Sincerely,

AES Consulting Engineers

A handwritten signature in black ink, appearing to read "Richard A. Costello", written over the printed name.

Richard A. Costello, P.E.
President

Enclosures

cc: Richard Gordon - Tanner, Mulkey and Gordon
J. Brady Pittman - HDL
Corinna Caldwell - Williamsburg Plantation



James City County Development Management Fax

Name: Deidre Wells

Firm or Company: AES

Facsimile Number: _____

Number of pages including this transmittal: 3

From: Darryl Cook

James City County

P.O. Box 8784

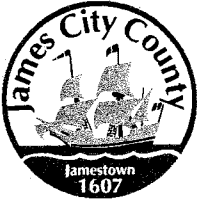
Williamsburg, Virginia 23187-8784

Office Phone: 757-253-_____

Fax Number: 757-253-6850

Comments: _____

If you do not receive all pages, call 757-253-6671 as soon as possible



DEVELOPMENT MANAGEMENT

101-E MOUNTS BAY ROAD, P.O. BOX 8784, WILLIAMSBURG, VIRGINIA 23187-8784
(757) 253-6671 Fax: (757) 253-6850 E-MAIL: devtman@james-city.va.us

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codecomp@james-city.va.us

ENVIRONMENTAL DIVISION

(757) 253-6670

environ@james-city.va.us

PLANNING

(757) 253-6685

planning@james-city.va.us

COUNTY ENGINEER

(757) 253-6678

INTEGRATED PEST MANAGEMENT

(757) 253-2620

August 23, 1999

Ms. Deirdre Wells
AES Engineering
5248 Olde Towne Road, Suite 1
Williamsburg, VA 23188

RE: VDOT/Williamsburg Plantation Combined BMP

Dear Ms. Wells:

I have reviewed the plan and calculations you provided regarding the modification of the BMP facility that is to be shared by VDOT and Williamsburg Plantation and I have the following comments:

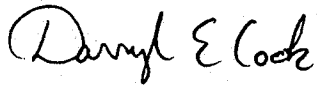
1. There is no proposed permanent pool for the marsh system. Although there is a large amount of wetlands vegetation growing in the bottom of the BMP due to the presence of groundwater, a wetland BMP attains its high removal efficiencies through the permanent retention of a certain volume of water. This retainage of water allows for the removal of nutrients by biological uptake. The facility as designed would release all the water from a given storm within approximately 24 hours, which would not allow for biological uptake to occur. Therefore, the elevation of the low release orifice needs to be raised to elevation 47.5 to create the retention area for the marsh. This will not require the removal of soil or vegetation from the existing bottom of the BMP but may require adjustment to other release structures.
2. Although I understand the stormwater requirements for the two projects differ in that the VDOT BMP does not need to meet our water quality criteria, it is not valid to design the wetland area only on the basis of the Williamsburg Plantation drainage area. In order to provide for the requirements of the watershed, a marsh volume of 25,604 cubic feet would be required for to be retained. At elevation 47.5, a storage volume of about 37,000 cubic feet is provided. This exceeds the volume requirement. However, the minimum required surface area to meet the loading requirements is 35,300 square feet while the pond provides about 25,000 cubic feet. However, as the BMP controls additional volume above the minimum requirement for the water quality volume drawdown, 88,057 vs. 56,898 cubic feet

required this will be acceptable. However, when the BMP is redesigned with the permanent 6-inch deep marsh, a similar excess volume will need to be provided to account for the shortfall in the marsh surface area.

3. When the pond is resubmitted, please revise the calculations in total; don't submit just the revised pages as it is difficult to follow the changes.

If you have any questions regarding this matter, please contact me at 253-6673.

Sincerely,

A handwritten signature in cursive script that reads "Darryl E. Cook". The signature is written in black ink and is positioned above the printed name.

Darryl E. Cook
Environmental Director, P.E.



COMMONWEALTH of VIRGINIA

DEPARTMENT OF TRANSPORTATION
1401 EAST BROAD STREET
RICHMOND, 23219-1939

CHARLES D. NOTTINGHAM
ACTING COMMISSIONER

New on...

October 22, 1999

To: All VDOT Drainage Designers

From: Charles McIver, State Hydraulics Engineer

Subject: REVISED STORMWATER MANAGEMENT REGULATIONS

Enclosed please find a draft version of I&I Memo LD-99(D)195.3 dated September 14, 1999. ~~This draft is final and complete~~ except it does not include copies of the insertable sheets which constitute the last 4 pages of the memo. Formal distribution of the I&I will be made as soon as the drawings are available. Also attached are some excerpts from the new State SWM Handbook and some example computations for water quality volume, water quality orifice sizing and drawdown time. The attachment (1998 STATE SWM REGULATIONS & 1999 SWM HANDBOOK) includes a list of the main points of the revisions on the cover sheet.

The State SWM Regulations were revised in 1998 but the revisions could not be implemented until the State SWM Handbook was distributed in 1999. The attached I&I Memo has been reviewed by the State Department of Conservation and Recreation (DCR) and is now approved after some comments from DCR were added to the memo.

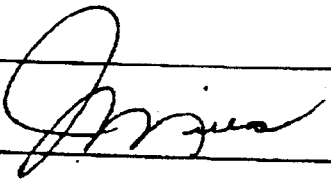
Please note that the effective date of this memo is applicable upon receipt. Also note that the intent of implementation is not to delay plan development for the sole purpose of compliance with the revised SWM regulations.

If you have any questions about applying the new SWM regulations, please contact the VDOT central office Hydraulics Section. Some form of additional instruction will follow in the near future.

*for
Scott
Thomas*

VIRGINIA DEPARTMENT OF TRANSPORTATION

LOCATION AND DESIGN DIVISION**INSTRUCTIONAL AND INFORMATIONAL MEMORANDUM**

GENERAL SUBJECT: MANAGEMENT OF STORMWATER	NUMBER: LD-99 (D) 195.3
SPECIFIC SUBJECT: Engineering and Plan Preparation	DATE: November 17, 1999
	SUPERSEDES: LD-94 (D) 195.2
SIGNATURE: 	

Changes are shaded.

EFFECTIVE DATE

- This memo is effective upon receipt for all projects entering the drainage design phase of plan development. For projects that are past the Field Inspection stage, revisions in the Stormwater Management design should not be made if only for the purpose of complying with this memo, but revisions should be made if significant plan revisions are needed for other reasons. The intent is to not delay plan development or project construction for the sole purpose of complying with this memo.

CURRENT REVISION

- Expanded instructions for Water Quantity Control and Water Quality Control, the design of Stormwater Management Basins, and for compliance with the latest revisions to the State Stormwater Management Regulations and the Stormwater Management Handbook produced by the State Department of Conservation and Recreation (DCR).

BACKGROUND

- Acts of the General Assembly have resulted in the issuance of Stormwater Management (SWM) and Erosion and Sediment Control (E&S) regulations. The general application to highway operations associated with these regulations is addressed in this memorandum. Instructions for the incorporation of the E&S details in plan assemblies are contained in the current version of IIM LD-(D) 11.

- Additional details and examples of the engineering application of the State SWM regulations in the design of VDOT projects can be obtained from the VDOT Hydraulics Section in any of the various district offices or the central office in Richmond.
- Further details and information regarding either the State SWM Regulations or the E&S Regulations can be obtained from: Virginia Department of Conservation and Recreation (DCR), 203 Governor Street, Richmond, VA 23219 or via the Internet: www.state.va.us/~dcr. Details may also be obtained from the SWM Handbook and the E&S Handbook published by DCR and available for reference in all VDOT Hydraulics Sections.

OBJECTIVE

SWM

- To inhibit the deterioration of the aquatic environment by instituting a stormwater management program that maintains both water quantity and quality post development runoff characteristics, as nearly as practicable, equal to or better than pre-development runoff characteristics.

E&S

- To effectively control soil erosion, sediment deposition, and post development runoff to minimize soil erosion and to prevent any sediment from escaping the project limits.

CRITERIA

General

- The runoff control provisions of both regulations are complementary and will be addressed under a single set of criteria. The information and instructions contained in this memorandum supersede all previous departmental documents. Where there are conflicts with previous instructions, this memorandum shall take precedence.
- The Erosion and Sediment Control Regulations apply to all activities that disturb 929 square meters (10,000 square feet) or more of land area.
- The Stormwater Management Regulations are applicable to all state projects.

EXEMPTIONS

- Linear development (highway) projects are exempt from the STORMWATER MANAGEMENT REGULATIONS provided that:
 1. Less than one acre of new impervious area will be added per outfall and
 2. There will be insignificant increase in peak flow rates and
 3. There are no existing or anticipated flooding or erosion problems downstream.

- "State Projects" are those land development activities wherein VDOT has funded any portion of the design, right of way acquisition, or construction (including public/private partnerships used for constructing state highways). Projects which are designed and constructed by other parties and that are accepted into the state system for maintenance after completion of construction (including subdivision streets) are not considered state projects and must conform to appropriate local regulations. Land development activities occurring within existing VDOT right of way, which are allowed by permit and which are designed, constructed, and funded by other parties, are not considered state projects and must conform to appropriate local regulations.
- "Land Development Project" is defined as a manmade change to the land surface that potentially changes its runoff characteristics as a permanent condition. The permanent condition should consider the effects of mature vegetative cover and should not be concerned with temporary changes due to construction activities. The temporary changes are addressed by the E&S regulations.

Water Quantity Control

- Water quantity control shall be governed by the Virginia Erosion and Sediment Control Regulations Minimum Standard 19 which requires an adequate receiving channel for stormwater outflows from all projects with more than 929 square meters (10,000 square feet) of land disturbance.
- Receiving channels, pipes and storm sewers shall be reviewed for adequacy based upon the following criteria:
 - Natural channels shall be analyzed by the use of a 2-year storm to verify that stormwater will not overtop channel banks or cause erosion of the channel bed and banks. All previously constructed manmade channels shall be analyzed by the use of a 10-year frequency storm to verify that the stormwater will not overtop the banks and analyzed by the use of a 2-year storm to verify that the stormwater will not cause erosion of the bed or banks. Pipes and storm sewer systems shall be analyzed by the use of a 10-year frequency storm to verify that the stormwater will be contained within the pipe or storm sewer system. The receiving channel at the outlet of the pipe or storm sewer shall be analyzed for adequacy of the 2 year storm for natural channels or the 10 year storm for man made channels.
- Water quantity control for the 1 year storm (in lieu of the 2 year storm required by Minimum Standard 19) may be needed if there is existing or anticipated erosion downstream. Control of the 1 year storm requires detaining the volume of runoff from the entire drainage area and releasing that volume over a 24 hour period. The computations are similar to those used for detaining the Water Quality Volume (WQV) and releasing over a 30 hour period. See the SWM Handbook by DCR: pages 1-23 and 5-38 thru 5-41. When the 1 year storm is detained for 24 hours there will be no need to provide additional or separate storage for the WQV if it can be demonstrated that the WQV will be detained for approximately 24 hours. The control of the 1 year storm may require a basin size that is 1.5 to 2 times larger than a basin used to control the increase in Q from a 2 year or a 10 year storm.
- Pre-development conditions shall be that which exist at the time the road plans are approved for right of way acquisition. All land cover shall be assumed to be in good condition regardless of actual conditions existing at the time the computations are made.

- Impounding structures (dams) that are not covered by the Virginia Dam Safety Regulations shall be checked for structural integrity and floodplain impacts for the 100-year storm event.
- Outflows from the stormwater management facilities shall be discharged into an adequate receiving channel.
- Existing swales being utilized as natural outfall conveyances for pre-development run-off will be considered as channels and, if the swale satisfactorily meets the criteria contained in Minimum Standard 19 of the Virginia Erosion and Sediment Control Regulations for post-development run-off, it will be considered as an adequate receiving channel.
- Surface runoff from drainage areas of three acres or more that pass through a disturbed area must be controlled by a sediment basin. The sediment basin shall be designed and constructed to accommodate the anticipated sediment loading from the land disturbing activity and adjacent property within the watershed that has a high erosion potential. The design of the outfall device or system shall take into account the total drainage area flowing through the basin.
- Construction of stormwater management facilities should be avoided in floodplains. When this is unavoidable, a special examination to determine the adequacy of the proposed stormwater management facilities during the 10-year flood shall be required. The purpose of this analysis is to ensure that the stormwater management facility will operate effectively. The stormwater management facility shall also be examined for structural stability during the passage of the 100-year flood event on the floodplain and shall be examined for any possible impacts caused by the basin on the 100-year flood characteristics of the floodplain. The construction of stormwater management facilities shall be in compliance with all applicable regulations under the National Flood Insurance Program.
- If it can be demonstrated that the total drainage area to the point of analysis within the receiving channel is 100 times greater than the contributing drainage area of the project, the receiving channel may be considered adequate, with respect to channel stability requirements under the Erosion & Sediment Regulations, without further computation.

Water Quality Control

- SWM design for water quality control is to be in accordance with the latest revisions to the Virginia SWM Regulations. The following comments represent the significant points of the current regulations and the page numbers given are referenced to the SWM Handbook from DCP.
 1. BMP requirements for quality control are "Technology Based" and the type of BMP is determined by the percent of new impervious area within the site (or Right of Way) per outfall (SEE TABLE 1- BMP SELECTION TABLE) and also the drainage area size (in accordance with the general design criteria as outlined in the SWM Handbook).
 2. BMP requirements for flooding or quantity control are set by the Erosion and Sediment Control Regulations Minimum Standard 19 for adequate receiving channels.
 3. Extended Detention Basins and Extended Detention Basins Enhanced require a Water Quality Volume (WQV) of 2x the standard WQV or 1" of Runoff from the new impervious area.

4. Extended Detention Basins and Extended Detention Basins Enhanced require a 30 hour drawdown time for the required WQV. The 3" minimum size water quality orifice has been eliminated. If the required orifice size is found to be significantly less than 3" an alternative water quality BMP should be investigated such as a linear facility which treats the first flush and allows large storms to overflow. The calculation procedure for drawdown time and orifice sizing is shown on PAGES 5-33 THRU 5-38 and also in example problems available from VDOT.
5. Sediment forebays should be used on Extended Detention Basins and Extended Detention Basins Enhanced with the volume set as $0.12 \times 0.25 \times$ the new impervious area or 10% of the required detention volume. SEE DETAILS PAGE 3.04-6. The stabilized overflow spillway may be constructed of rip rap or concrete.
6. Suggested details for the Extended Detention Basin are shown on PAGES 3.07-04 AND 3.07-5. The rip rap lined low flow channel thru the basin is not recommended by VDOT due to maintenance concerns.
7. Suggested details for the Extended Detention Basin Enhanced are shown on PAGES 3.07-6 AND 3.07-7. The geometric design will probably need to be more symmetrical than shown in order to construct the basin to the dimensions needed.
- Non-structural practices including, but not limited to, control of land use development, minimization of impervious areas and curbing requirements, open space acquisition, floodplain management, and protection of wetlands may be utilized as appropriate in order to at least partially satisfy the water quality requirements. Approval of such non-structural measures will be secured in advance from the Department of Conservation and Recreation (DCR).

MULTI-USE BASINS

Quantity Control – Quality Control – Temporary Sediment Storage

SWM basins will normally be used for both quantity control and for quality control. Under the revised regulations some basins may occasionally only be needed for quality control. Most SWM basins are needed to serve as temporary sediment basins and the design and computations will need to address the dual function. The design that is needed for a permanent SWM basin may need to provide additional temporary sediment storage volume that is in excess of the required WQV. The two different volumes (WQV and temporary sediment storage volume) should not be added together and the larger of the two should govern the design. The additional volume needed for sediment storage may be provided by excavating the bottom of the basin lower than required for WQV. The permanent outlet structure (riser or wall) can be temporarily altered to serve as the control structure for the sediment basin. (See the enclosed design detail drawings and the DCR SWM Handbook). When the project is nearing completion and the basin is no longer needed for sediment control, the basin can be easily converted to a permanent SWM basin.

IMPLEMENTATION

Plan Preparation

- Standard and minimum plan projects shall show stormwater management and erosion control measures on the plans as directed in IIM LD- (D) 11 and the Road Design Manual.
- No-plan projects must have the erosion and sediment control measures included in the construction narrative addressing their placement. This narrative may be supplemented by appropriate "simple" sketches. Stormwater management facilities may be addressed in a similar fashion provided sufficient detail is included to ensure their proper construction. When this is not practicable, additional sketches shall be included in the no-plan assembly to define the construction of these items.
- Any other type of project activity that does not have a plan, such as some SAAP Projects, shall conform to the no-plan requirements.
- Maintenance activities which disturb more than 929 square meters (10,000 square feet) must have a plan developed by the appropriate personnel that addresses the erosion and sediment control requirements for that activity. Maintenance activities which involve a "Land Development Project" of one acre or more of land must have a stormwater management plan. The plan shall conform to the requirements for a no-plan project.
- Normal ditch cleaning and pulling of shoulders are not considered land disturbing activities for the purposes of erosion and sediment control if less than 929 square meters (10,000 square feet) of drainage area is disturbed feeding any one pipe or ditch outlet.

Foundation Data

- Foundation data (a soil boring) for the base of the dam should be requested for all Stormwater Management Basins in order to determine if the native material will support the dam and not allow ponded water to seep under the dam. An additional boring near the center of the basin should also be requested if:
 1. Excavation from the basin may be used to construct the dam, OR
 2. Rock may be encountered in the area of excavation, OR
 3. A high water table is suspected which may alter the performance of the SWM basin.

For large basins, more than one boring for the dam and one boring for the area of the basin may be needed. The number and locations of the borings are to be determined by the drainage designer.

- The foundation data should be requested by the drainage designer when the request is initiated for culvert foundation data. See IIM LD- (D) 121.

Right of Way

- Permanent stormwater management facilities may be placed in fee right of way or in permanent easements. It is recommended that all permanent stormwater management facilities (dams, ponds, risers, etc.) be placed within fee right of way initially. Ditches and similar features may initially be placed in permanent easements. The final decision on right of way versus permanent easement can be made at the field inspection or as a result of the design public hearing. The Department will generally be amenable to the desires of affected landowners in this matter. The multiple use of property for stormwater management and such features as utilities is permissible. The decision on the advisability of such actions must be made on an individual site basis.

Table 1***BMP SELECTION TABLE**

Water Quality BMP	Target Phosphorus Removal Efficiency	Percent Impervious Cover**
Vegetated filter strip	10%	16-21%
Grassed swale	15%	
Constructed wetlands	30%	
Extended detention (2xWQ Vol)	35%	22-37%
Retention basin I (3xWQ Vol.)	40%	
Bioretention basin	50%	
Bioretention filter	50%	
Extended detention-enhanced	50%	38-66%
Retention basin II (4xWQ Vol)	50%	
Infiltration (1xWQ Vol)	50%	
Sand filter	65%	
Infiltration (2xWQ Vol)	65%	67-100%
Retention basin III (4xWQ Vol with aquatic bench)	65%	

* Innovative or alternate BMPs not included in this table may be allowed at the discretion of DCR.

** Percent Impervious Cover: New impervious area within the site or Right of Way per outfall.

DETAILS FOR DESIGN OF DAMS

VDOT STORMWATER MANAGEMENT BASINS

The following details are to be incorporated into the design of VDOT Stormwater Management (SWM) Basins in order to be in compliance with the State SWM Regulations Revisions of 1998 and the SWM HANDBOOK of the Virginia Department of Conservation and Recreation (DCR). The revisions are also due to concerns with seepage thru the dam and along the culvert due to the ponding of water in the basins being of longer duration than previous designs that used a minimum 3" water quality orifice.

1. Foundation data for the dam is to be secured from the Materials Division in order to determine if the native material will support the dam and not allow ponded water to seep under the dam.
2. The foundation material under the dam and the material used for the embankment of the dam should be type A-4 or finer* and/or meet the approval of the Materials Division. If the native material is not adequate, the foundation of the dam is to be undercut a minimum of 4' or the recommendation of the Materials Division. The backfill and embankment material must meet the above soil classification or the design of the dam may incorporate a trench lined with a membrane (such as bentonite penetrated fabric or an HDPE or LDPE liner) and be approved by the Materials Division.
3. The pipe culvert under or thru the dam is to be concrete sewer pipe with rubber gaskets. Pipe Specifications: 232 (AASHTO M170), Gasket Specification: 212 (ASTM C443)
4. A concrete cradle is to be used under the pipe to prevent seepage thru the dam. The concrete cradle is to extend from the riser or inlet end of the pipe to the outlet of the pipe. See attached Special Design Drawing No. 2209.
5. If the height of the dam is greater than 15' the design of the dam is to include a Homogenous Embankment with seepage controls or Zoned Embankment or similar design and is to be approved by the Materials Division.

*In accordance with the AASHTO Classification System (M145)

DESIGN GUIDELINES FOR STORMWATER (SWM) BASINS



The top width (W) of the SWM basin dam should be 3m (10') minimum to facilitate both construction and maintenance.

The side slopes should be no steeper than 3:1 to permit mowing and cleanout. The bottom slope of the basin should be no more than 2% or no less than 0.5%.

The depth of the basin to the primary overflow (crest of riser, or orifice or weir) should be no more than 1m (3 ft.) if possible, in order to reduce the hazard potential. If the depth needs to be more than about 1m (3 ft.) fencing should be considered.

All SWM basins should be reviewed for the needs of fencing, barricades and no trespassing signs in accordance with the VDOT guideline for Fencing of SWM Basins.

The length to width ratio should be about 3:1 (wider at the outlet end). If the ratio is less than about 2:1, and if there is concern that the velocity of flow through the basin is high, consideration should be given to using baffles within the basin to reduce velocity. Baffles should be constructed of "pervious" type material such as snow fence rather than earth berms which do not reduce the velocity.

Perimeter Controls

- Fencing of SWM Basins

- Fencing of stormwater management basins is normally not required and should not be used for most basins due to:

- Insignificant Hazard

Ponding of water in the basin should only occur with very heavy storms and be noticeable for a few hours. The ponded depth will normally be no more than about 1 meter (3 feet). Ponds and lakes are almost never fenced, even though they may be located in subdivisions and have deep, permanent ponding.

- Limits Maintenance

Fencing will limit maintenance operations and could deter the frequency of maintenance. Maintenance operations can damage fencing particularly if equipment becomes stuck.

- Fencing of SWM basins may occasionally be needed and should be used when:

- Basin is deep with ponded depth greater than about 1 meter (3 feet) and/or has steep side slopes with 2 or more side slopes steeper than 3:1;

or

- Basin is in close proximity to schools, playgrounds or similar areas where children may be expected to frequent;

or

- Recommended by the Field Inspection Report, the Resident Engineer or the City/County (where City/County will take over maintenance responsibility.)

- Barricades

- A chain or gate may be needed on some basins to prohibit vehicular access if there is concern with dumping or other undesirable access.

- Signs

- "No Trespassing signs" shall be considered for use on all basins, whether fenced or unfenced and should be recommended as needed on the Field Inspection Report.

Regional Facilities

- There are many cases where it is more feasible to develop one large stormwater management facility to control a watershed area rather than a number of small individual facilities controlling small drainage basins. The concept of regional stormwater management facilities is endorsed by VDOT provided that certain requirements are met.
- Development and use of regional stormwater management facilities must be a joint undertaking by VDOT and the local governing body. The site must be part of a master stormwater management plan developed by the local governing body and any agreements related to these facilities must be consummated between VDOT and the local governing body. VDOT will not enter into an agreement with private individuals or corporations.
- Where the roadway embankment serves as an impounding structure, the right of way line will normally be set at the inlet face of the drainage structure. The local government will be responsible for the maintenance and liabilities outside of the right of way and VDOT will accept the same responsibilities inside the right of way.
- Hydraulic design of regional management facilities must address any mitigation needed to offset increases in runoff from the roadway. Stormwater management facilities located upstream of the roadway shall provide sufficient mitigation of peak outflow to compensate for roadway runoff which may bypass the facility.

Maintenance

- Requirements for maintenance of stormwater management facilities, the recommended schedule of inspection and maintenance, and the identification of persons responsible for the maintenance will be addressed by the Maintenance Division.

Future Reconstruction

- If a stormwater management facility is constructed to address the increase in runoff from a current project and, at some time in the future, is displaced to accommodate future construction, a new facility constructed at that time must address increases in runoff due to the future construction and the increases in runoff that were mitigated by the original stormwater management facility.

Reporting

- VDOT is required to submit an annual report to the Department of Conservation and Recreation (DCR) that identifies the location, number and type of stormwater management facilities installed during the preceding year, their storage capacities, the affected water body, and a summary of any water quality monitoring data associated with the facility. A database has been established on the Hydraulics Section's telecommunication file system to record this type of data for all projects. It shall be the responsibility of the district drainage engineer and the hydraulic design engineers in the Central office to ensure that the required information is logged on the database for all stormwater management facilities that are designed for roadway projects. In order for the database to reflect those facilities constructed during the preceding year, it is recommended that the required information be logged at the time of the first submission of plans to the Construction Division. The reporting period will be from July 1 to June 30.

PLAN DETAILS

Stormwater Management Drainage Structure Standard SWM-D

- To be used at all applicable locations where a drop inlet type control structure is desired.

Stormwater Management Riser Pipe Standard SWM-RP

- To be used at all applicable locations where an open top manhole type control structure is desired.
- Diameters from 900 mm to 1500 mm in 150 mm increments (36" to 60" in 6" increments).
- Height of structure above outlet pipe invert should be limited to about 1 meter (3 feet) maximum.

Stormwater Management Dam

- To be used at locations where a wall type control structure is desired (includes modifications to standard endwalls). Normally used for shallow depths of ponding.
- Details to be provided for individual locations.

Details of control structures other than those above shall be submitted to the office of the State Hydraulics Engineer to facilitate future development of standard details.

Stormwater Management Details Standard SWM-DR

- Provide at each location requiring a water quality orifice. The size opening for the water quality orifice shall be specified for each basin.

Access

- A means of access for inspection and maintenance personnel shall be provided at each SWM facility location.
 - A turnaround should be provided on vehicular entrances when needed based upon accessibility and traffic volume.
 - Appropriate surface material shall be provided for each vehicular entrance.
-

Method of Measurement – Basis of Payment

Stormwater Management Drainage Structure (SWM-1):

- Basis of payment to be linear meters (feet) measured from invert of structure to top of concrete cover.

Stormwater Management Riser Pipe:

- Basis of payment to be linear meters (feet) of the size specified measured from invert of structure to the top of the structure.

Stormwater Management Dam:

- Basis of payment to be m^3 (cubic yards) of Concrete Class A3 Miscellaneous and kilograms (pounds) of Reinforcing Steel.

Grading:

- Excavation for stormwater management basins will be measured and paid for as m^3 (cubic yards) of Stormwater Management Basin Excavation.
 - If additional fill material is needed for dams or berms this will be measured and paid for as m^3 (cubic yards) of Regular Excavation, Borrow Excavation or Embankment.
 - The Grading Diagram is to reflect how the m^3 (cubic yards) of Stormwater Management Excavation and m^3 (cubic yards) of Embankment or Borrow is to be distributed.
-

Stormwater Management Summary

- All items related to the construction of stormwater management facilities shall be summarized, by location, in a separate summary located on or near the Drainage Summary (see attached example).
- If Borrow or Embankment is needed, include in roadway totals on Grading Diagram and Summary.

PAY ITEMS

The following pay items are established:

<u>PAY ITEM</u>			<u>UNIT</u>		<u>ITEM CODE</u>
			Metric	Imperial	
SWM Basin Excavation			m ³	Cu. Yds.	27545
SWM Drainage Structure (SWM-1)			m	Lin. Ft.	27550
SWM Riser Pipe	900 mm	(36")	m	Lin. Ft.	27560
SWM Riser Pipe	1050 mm	(42")	m	Lin. Ft.	27562
SWM Riser Pipe	1200 mm	(48")	m	Lin. Ft.	27564
SWM Riser Pipe	1350 mm	(54")	m	Lin. Ft.	27566
SWM Riser Pipe	1500 mm	(60")	m	Lin. Ft.	27568
SWM Dam:			m ³ kg	Cu. Yds.	00525
Conc. Cl. A3 Misc. Reinf. Steel				Lbs.	00540

INSERTABLE SHEETS

The following Insertable Sheets are available in the Insertable Sheet Directory for inclusion in Imperial plan assemblies:

- SWM Details – SDSD # 2209 (See attached)
- SWM Drainage Structure (SWM-1) – SDSD # 2216 (See attached)
- SWM Riser Pipe – SDSD # 2216-A (See attached)

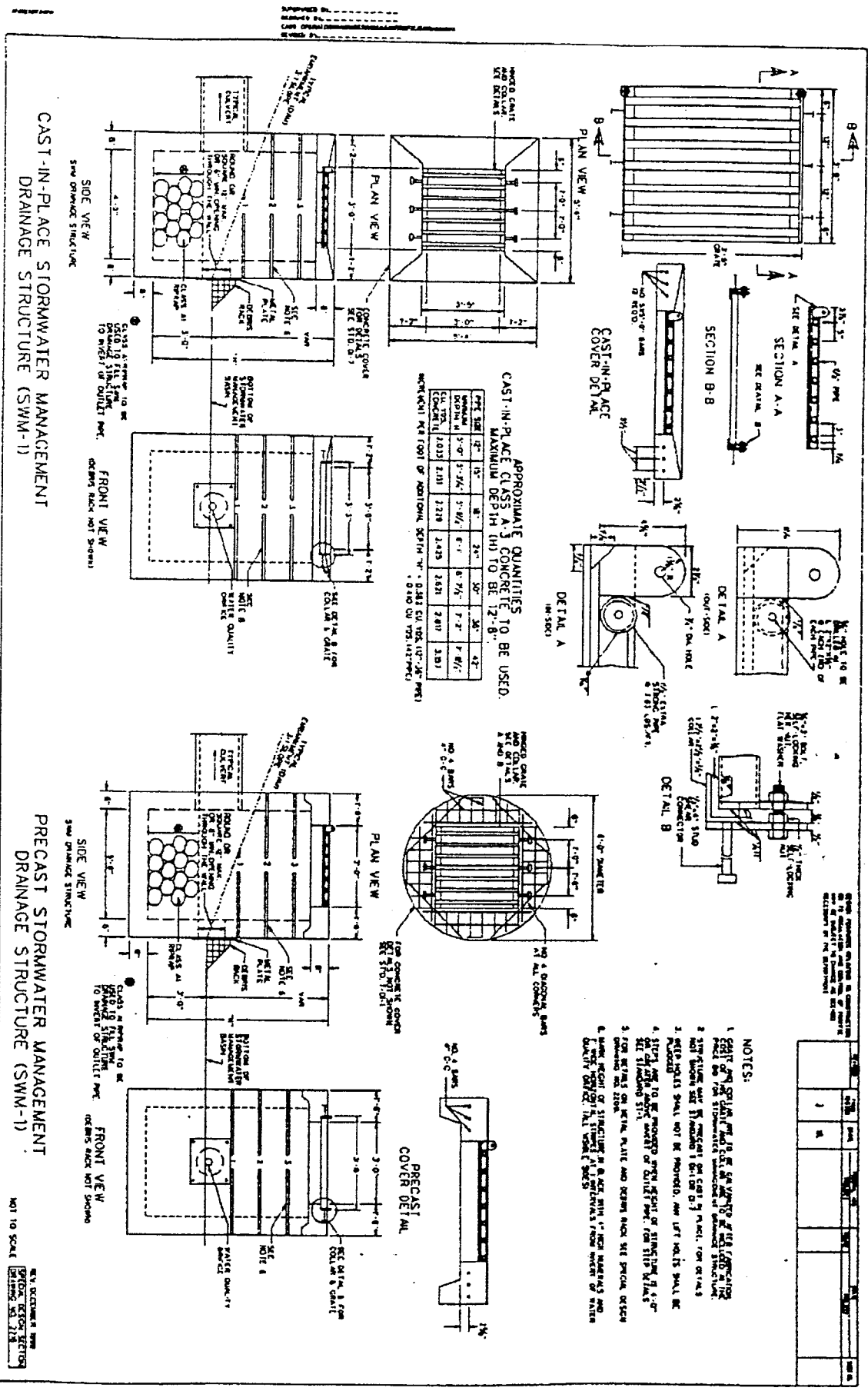
SAMPLE SUMMARY

STORMWATER MANAGEMENT CONTROL SUMMARY										
(METRIC)										
LOCATION	STORMWATER MANAGEMENT BASIN EXCAVATION	STORMWATER MANAGEMENT DRAINAGE STRUCTURE SWM-1	STORMWATER MANAGEMENT RISER PIPE					STORMWATER MANAGEMENT DAM		DRY RIP RAP CLASS
			900 m	1050 m	1200 m	1350 m	1500 mm	CONC. CLASS A-3 MISC.	REINF. STEEL	
	m ³	meters	meters					m ³	kg	Metric Tons
TOTAL										

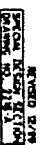
STORMWATER MANAGEMENT CONTROL SUMMARY										
(IMPERIAL)										
LOCATION	STORMWATER MANAGEMENT BASIN EXCAVATION	STORMWATER MANAGEMENT DRAINAGE STRUCTURE SWM-1	STORMWATER MANAGEMENT RISER PIPE					STORMWATER MANAGEMENT DAM		DRY RIP RAP CLASS
			36"	42"	48"	54"	60"	CONC. CLASS A-3 MISC.	REINF. STEEL	
	C.Y.	Lin. Ft.	Lin. Ft.					C.Y.	Lbs.	Tons.
TOTAL										

SPECIAL PROVISION SECTIONS 302 AND 303

- The current Special Provision/Copied Note for measurement and payment for stormwater management items is accessible through the Internet at <http://www.vdot.state.va.us>. The path is "Opportunities Network", "Construction and Maintenance Contracting Opportunities", "Resources", "Road and Bridge Specifications". Win Zip is available from this web site to enable viewing of the information. Questions pertaining to the web site may be addressed to the Construction Division (Ms. Mary Roane) at (804) 786-2124. Questions concerning the Special Provisions/Copied Notes may be addressed to Ms. Norma Gilbert at (804) 786-2356. Please note the effective advertisement date for these provisions.



NOTE: THIS IS A SAMPLE INSERTABLE SHEET.
FOR A CURRENT VERSION, ACCESS THE
CADD INSERTABLE SHEET DIRECTORY.



**NOTE: THIS IS A SAMPLE INSERTABLE SHEET.
FOR A CURRENT VERSION, ACCESS THE
CADD INSERTABLE SHEET DIRECTORY.**

1998 STATE SWM REGULATIONS & 1999 SWM HANDBOOK

1. BMP requirements for quality control are "Technology Based" and the type of BMP is determined by the percent of impervious area within the site (or Right of Way) per outfall. SEE TABLE I
2. BMP requirements for flooding or quantity control are set by the Erosion and Sediment Control Regulations Minimum Standard 19 for adequate receiving channels.
3. Flood control for the 1 year storm in lieu of the 2 year storm may be needed if there is existing or anticipated erosion downstream.
SEE 4VAC 3-20-81 AND PAGES 5-38 THRU 5-41
4. Extended Detention Basins and Extended Detention Basins Enhanced require a Water Quality Volume (WQV) of 2 x the standard WQV or 1" of Runoff from the new impervious area.
5. Extended Detention Basins and Extended Detention Basins Enhanced require a 30 hour drawdown time for the required WQV. The 3" minimum size water quality orifice has been eliminated. The calculation procedure for drawdown time and orifice sizing is shown on PAGES 5-33 THRU 5-38 and the attached example problem.
6. Sediment Forebays should be used on Extended Detention Basins and Extended Detention Basins Enhanced with the volume set as 0.1" - 0.25" x the new impervious area or 10% of the required detention volume. SEE DETAILS PAGE 3.04-6. The stabilized overflow spillway is preferred as rip rap rather than concrete.
7. Suggested details for the Extended Detention Basin are shown on PAGES 3.07-4 AND 3.07-5. The rip rap lined low flow channel thru the basin is not recommended by VDOT due to maintenance concerns.
8. Suggested details for the Extended Detention Basin Enhanced are shown on PAGES 3.07-6 AND 3.07-7. The geometric design will probably need to be more symmetrical than shown in order to construct the basin to the dimensions needed.
9. The SWM Handbook shows details of dam design and culvert installation within the dam as based upon major or high dams with permanent pools. The dams for SWM basins by VDOT are usually less than about 8' high and without permanent pools. VDOT is developing dam design details similar to those shown in the SWM Handbook that are specifically intended for use in shallow SWM basins that are constructed and maintained by VDOT.

EXEMPTIONS

Linear development (highway) projects are exempt from the SWM REGULATIONS (not the E&S Regulations) provided that:

- (1) Less than one acre of new impervious area will be added per outfall and
- (2) There will be insignificant increases in peak flow rates and
- (3) There are no existing or anticipated flooding or erosion problems downstream.

Linear development projects are not exempt from the E&S REGULATIONS and must meet Minimum Standard 19 for Adequate Receiving Channels.

VIRGINIA STORMWATER MANAGEMENT LAW and REGS.

CHAPTER 1

Table 1*

Water Quality BMP	Target Phosphorus Removal Efficiency	Percent Impervious Cover
Vegetated filter strip	10%	16-21%
Grassed swale	15%	
Constructed wetlands	30%	22-37%
Extended detention (2 x WQ Vol)	35%	
Retention basin I (3 x WQ Vol)	40%	
Biorotation basin	50%	38-66%
Biorotation filter	50%	
Extended detention-enhanced	50%	
Retention basin II (4 x WQ Vol)	50%	
Infiltration (1 x WQ Vol)	50%	
Sand filter	65%	67-100%
Infiltration (2 x WQ Vol)	65%	
Retention basin III (4 x WQ Vol with aquatic bench)	65%	

* Innovative or alternate BMPs not included in this table may be allowed at the discretion of the local program administrator or the Department. Innovative or alternate BMPs not included in this table which target appropriate nonpoint source pollution other than phosphorous may be allowed at the discretion of the local program administrator or the Department.

Percent Impervious Cover: New impervious area within the site or Right of Way per outfall.

EXEMPTIONS

Linear development (highway) projects are exempt from the STORMWATER MANAGEMENT REGULATIONS provided that: (1) less than one acre of new impervious area will be added per outfall; (2) there will be insignificant increases in peak flow rates and; (3) there are no existing or anticipated flooding or erosion problems downstream.

Linear development projects are not exempted from the EROSION AND SEDIMENT CONTROL REGULATIONS and must meet Minimum Standard #19 for Adequate Receiving Channels.

EXAMPLE PROBLEM - WQV, DRAWDOWN TIME & ORIFICE SIZING

For Compliance With 1998 State SWM Regs. & Handbook

WATER QUALITY VOLUME (WQV)

Assume basin must meet 1998 State SWM Regulations and basin must be an EXTENDED DETENTION BASIN.

WQV is defined as 1/2" of RUNOFF from the new impervious area.

The REQUIRED WQV for an Extended Detention Basin = 2 x WQV
New Impervious Area = 2.4 acres

WQV = 1/2" x 2.4 ac. = 4360 cubic feet

REQUIRED WQV for Extended Detention Basin = 4360 x 2 = 8720 cf

NOTE: To achieve the REQUIRED WQV of 8720 cf, the 24" orifice in the riser will need to be raised from elev. 202.9 to an invert of 203.3. This will require that all of the original routing computations for the various hydrographs will have to be revised.

DETERMINE ORIFICE SIZE
(for required 30 hour drawdown time)

METHOD #1 - MAXIMUM HYDRAULIC HEAD

From instructions in the 1998 Draft of the DCR Handbook for SWM on pages 5-34 and 5-35:

Find ponded elevation for Req'd. WQV:

From stage vs elevation table @elev 203.3 Vol. = 8720±cf

Max. head = 203.3 - 202.2 = 1.1'

Note: Actual h on orifice is to center of orifice

Since size of orifice is unknown, use 1.1' which is probably only about 1" too high and is insignificant.

$$Q \text{ av'g.} = \frac{8720 \text{ cf}}{(30 \text{ hr.})(3600 \text{ sec./hr.})} = 0.081 \text{ cfs}$$

$$Q \text{ max} = 0.081 \times 2 = 0.16 \text{ cfs}$$

$$\text{Orifice size: } a = \frac{Q}{C\sqrt{2}gn} = \frac{0.16}{0.6\sqrt{2 \times 32.2 \times 1.1}} = 0.032 \text{ sf.}$$

From Table: Use 2 1/2" ORIFICE

(continued)

DRAWDOWN TIME

METHOD #2 Routing of WQV

Comments: The routing of WQV thru a basin may not be possible with many routing software programs. The problem can be due to the need of inputting a HYG for a minimum of about 30 hours with the last 29.5 hours having 0.0 inflow. The problem could also be due to the orifice size not being acceptable for something as small as a 2 1/2" orifice.

.....

To develop a hydrograph for the WQV (following the example in the SWM Handbook) you need only to calculate a HYG for the new impervious area and use the time of concentration pertinent to that impervious areas and its proximity to the basin. Assuming that the basin is to be an extended detention basin, the required WQV will be 2 x WQV which is 1" of runoff from the new impervious area. The TR-55 Hydrograph method will probably be the easiest HYG to provide 1" of runoff. The process would involve using Rainfall (RF) of 1.2" and a CN of 98 for the impervious area. This will produce 1" of runoff from the (new) impervious area.

.....

ALTERNATIVE METHOD OF ROUTING WQV TO FIND DRAWDOWN TIME

The SWM Handbook defines the drawdown time as from the time the WQV (elevation) is reached until the basin is emptied. This is based upon a storm producing only the amount of runoff required for the WQV - For an extended detention basin - 1".

The normally required routing of the 2 year storm can also be used for drawdown time with some slight adjustment providing that the routing software will accomodate such. The receding limb of the inflow hydrograph will need to be adjusted to show either 0.0 or 0.01 inflow up to a time of about 30 hours and the software will need to calculate small orifices such as 2". By this method the drawdown time for WQV is actually from the time that the basin recedes to the WQV elevation until the basin is empty. For practical purposes, if the routing shows the basin is not empty at 30 hours, this is close enough.

Please note figure 2-1 from the SWM Handbook that shows the relationship of detention time to % efficiency of pollutant removal. The % efficiency does not increase significantly beyond 6 hours. Therefore the orifice size calculations using method #1 should be sufficient. This is especially true considering the probability that small orifices will probably stay clogged.

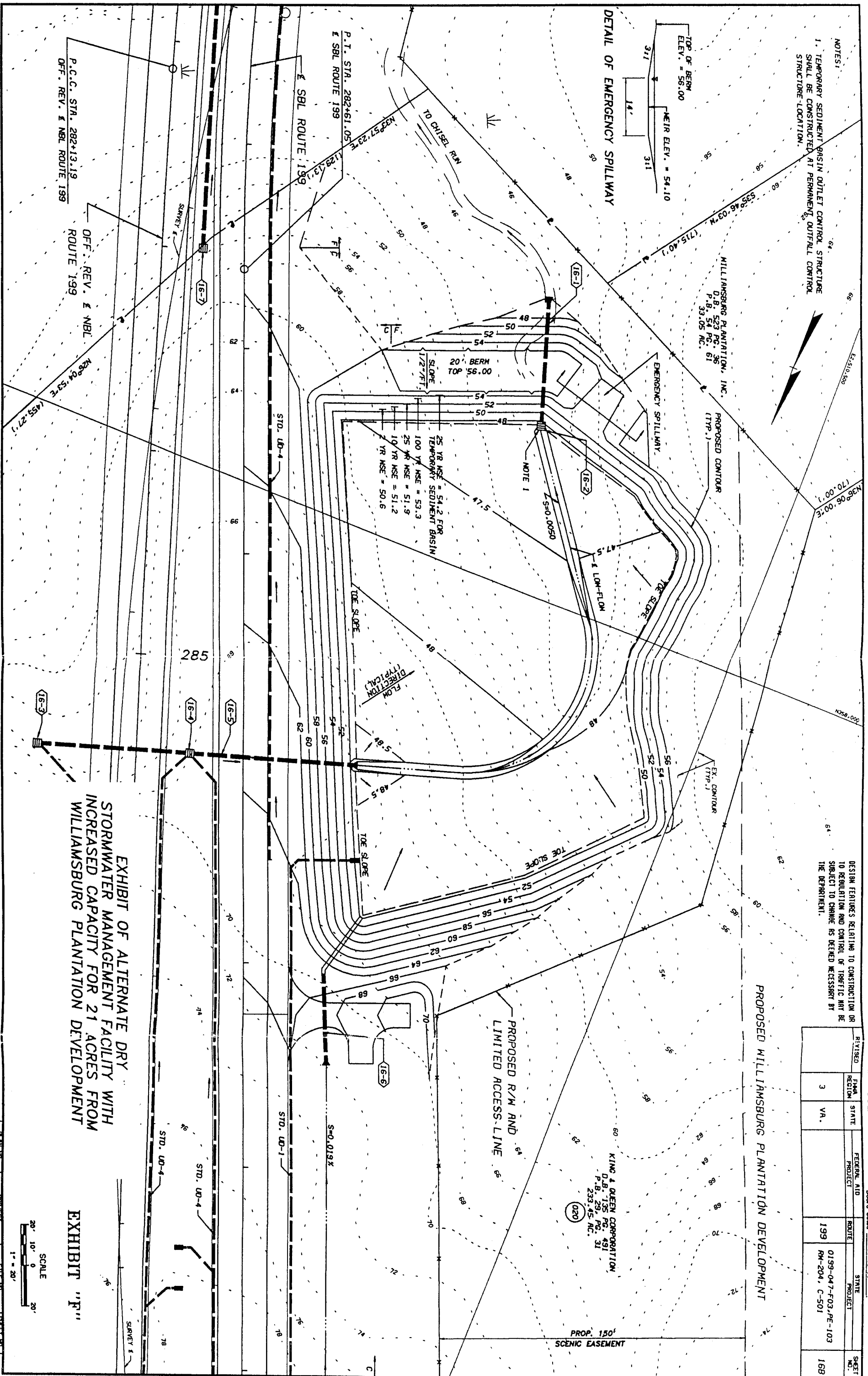


EXHIBIT OF ALTERNATE DRY STORMWATER MANAGEMENT FACILITY WITH INCREASED CAPACITY FOR 21 ACRES FROM WILLIAMSBURG PLANTATION DEVELOPMENT

EXHIBIT "F"

PROPOSED WILLIAMSBURG PLANTATION DEVELOPMENT

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT.

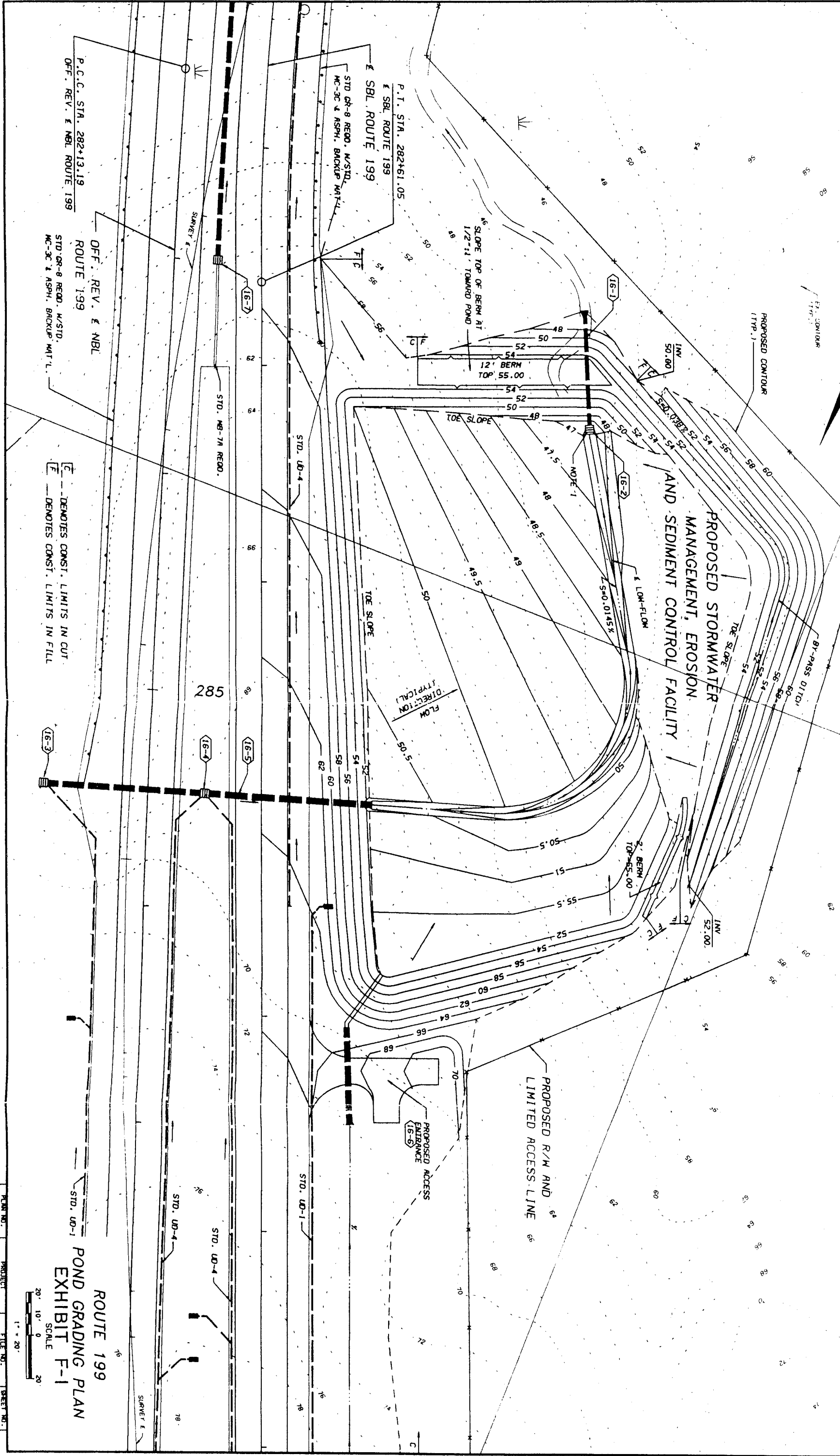
REVISED	FINAL REGION	STATE	FEDERAL AID		STATE		SHEET NO.
			PROJECT		PROJECT		
	3	VA.			199	0199-047-F03, PE-103 RM-204, C-501	168

LIMITED ACCESS HIGHWAY
By Resolution of Commonwealth Transportation Board dated 10-18-88

NOTES:
1. TEMPORARY SEDIMENT BASIN OUTLET CONTROL STRUCTURE SHALL BE CONSTRUCTED AT PERMANENT OUTFALL CONTROL STRUCTURE LOCATION.

DESIGN FEATURES RELATIVE TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT.

LIMITED ACCESS HIGHWAY		By Resolution of Commonwealth Transportation Board dated 12-10-98		STATE		SHEET NO.
REVISED	FINAL	STATE	FEDERAL AID	ROUTE	PROJECT	
3	VA.			199	0199-047-F03, PE-103 RW-204, C-501	168



P.C.C. STA. 282+13.19
OFF. REV. & NBL ROUTE 199

OFF. REV. & NBL ROUTE 199
STD. CR-8 REOD. W/STD. MC-3C & ASPH. BACKUP MAT'L.

--- DENOTES CONST. LIMITS IN CUT
--- DENOTES CONST. LIMITS IN FILL

ROUTE 199
POND GRADING PLAN
EXHIBIT F-1

SCALE
20' 10' 0' 20'

PLAN NO.	PROJECT	FILE NO.	SHEET NO.
A	0199-047-F03		168

REVISED AREA "G"

*Combined Stormwater Management &
Temporary Sediment Basin Calculations*

ROUTE 199
PROJECT 0199-047-F03, RW-204, C-501

EXHIBIT "G"

FLOW ANALYSIS FOR
PRE-DEVELOPMENT AND
POST-DEVELOPMENT CONDITIONS

PRE-DEVELOPMENT CONDITION

	Subarea Surface	Area (Ac.)	C Factor	C * A
1.	Average Grass	25.70	0.45	11.57
2.				
3.				
Total Area:		25.70	Total C*A:	11.57

Composite C Factor = 0.45

Time of Concentration

2000 ' Overland Flow @ 4.00 % = 21.3 min

Peak Q for multi-year storm

Year	Area Ac.	Cf	C	Tc min	i in/hr	Q cfs
2	25.70	1.00	0.45	21	3.27	37.9
10	25.70	1.00	0.45	21	4.47	51.7
25	25.70	1.10	0.45	21	5.22	66.3
100	25.70	1.25	0.45	21	6.35	91.8

POST-DEVELOPMENT CONDITION

	Subarea Surface	Area (Ac.)	C Factor	C * A
1.	Average Grass	31.87	0.35	11.15
2.	Paved	13.24	0.90	11.92
3.	Developed	1.59	0.55	0.87
Total Area:		46.70	Total C*A:	23.95

Composite C Factor = 0.51

Time of Concentration

480 ' Overland Flow @ 4.00 % = 7.8 min
1900 ' Channel Flow @ 2.00 fps = 15.8 min

Peak Q for multi-year storm

Year	Area Ac.	Cf	C	Tc min	i in/hr	Q cfs
2	46.70	1.00	0.51	24	3.08	73.7
10	46.70	1.00	0.51	24	4.23	101.2
25	46.70	1.10	0.51	24	4.94	130.1
100	46.70	1.25	0.51	24	6.03	180.4

POND-2 Version: 5.17
S/N:

0199-047-F03-C501-RW204
AREA G
S.W.M. POND - RTE 199 STA. 285
VOLUME vs ELEVATION TABLE

CALCULATED 02-12-1994 22:37:55
DISK FILE: C:\BANDAK\G-199 .VOL

Planimeter scale: 1 inch = 1 ft.

Elevation (ft)	Planimeter (sq.in.)	Area (sq.ft)	A1+A2+sq ² (A1*A2) (sq.ft)	* Volume (cubic-ft)	Volume Sum (cubic-ft)
47.00	0.00	0	0	0	0
47.50	3,200.00	3,200	3,200	533	533
48.00	15,210.00	15,210	25,387	4,231	4,764
49.00	31,460.00	31,460	68,545	22,848	27,613
50.00	32,920.00	32,920	96,562	32,187	59,800
51.00	34,470.00	34,470	101,076	33,692	93,492
52.00	36,020.00	36,020	105,726	35,242	128,734
53.00	37,560.00	37,560	110,362	36,787	165,521
54.00	39,100.00	39,100	114,982	38,327	203,849
55.00	40,815.00	40,815	119,863	39,954	243,803
56.00	42,530.00	42,530	125,009	41,670	285,473

$$IA = (\text{sq. rt}(\text{Area1}) + ((E_i - E_1) / (E_2 - E_1)) * (\text{sq. rt}(\text{Area2}) - \text{sq. rt}(\text{Area1})))^2$$

where: E1, E2 = Closest two elevations with planimeter data
Ei = Elevation at which to interpolate area
Area1, Area2 = Areas computed for E1, E2, respectively
IA = Interpolated area for Ei

* Incremental volume computed by the Conic Method for Reservoir Volumes.

$$\text{Volume} = (1/3) * (EL2 - EL1) * (\text{Area1} + \text{Area2} + \text{sq. rt.}(\text{Area1} * \text{Area2}))$$

where: EL1, EL2 = Lower and upper elevations of the increment
Area1, Area2 = Areas computed for EL1, EL2, respectively
Volume = Incremental volume between EL1 and EL2

PROJECT NAME: ROUTE 199

DEPARTMENT: CIVIL

PROJECT PART: DRAINAGE DESIGN

SHEET NO: _____ OF _____

COMPUTED BY: 12B DATE: 4/29/94

SPEC. DIVISION: EROSION CONTROL & S.W.M.

CHECKED BY: _____ DATE: _____

TEMPORARY SEDIMENT BASIN CALCULATIONS

46.70 AC. DRAINAGE AREA X 67 CY/ACRE "WET STORAGE" = 3,129 CY.
"DRY STORAGE" = 3,129 CY.
TOTAL STORAGE = 168,966 C.F. = 6,258 CY.

WSE FOR TOTAL STORAGE - 168,966 C.F. = 53.09 SAY 53.10

WSE FOR WET STORAGE - 84,483 C.F. = 50.73 SAY 50.75

LENGTH TO WIDTH RATIO

L = 265' AREA OF WET STORAGE → 34,080 S.F.

$W_e = A/L = 129'$

$L/W_e = 265/129 = 2.05 \rightarrow 2.05 > 2 \therefore$ NO BAFFLES REQUIRED

AN EMERGENCY SPILLWAY WILL BE USED → 25-YR WSE SHOULD BE AT LEAST 1.0' BELOW TOP OF EMBANKMENT WHICH IS 54.10.

DESIGN 25-YR FLOW = 66.3 CFS - 38 CFS RISER CONTRIBUTION AND 28.0 CFS WEIR CONTRIBUTION; 28 CFS WITH 14' BOTTOM WEIR GIVES WSE = 54.10 + .9 = 55.00 WHICH IS 1.0' BELOW 56.00

EMERGENCY SPILLWAY

$Q_e = 66.3 - 37.9 = 28$ CFS FROM 2-YR & 25-YR DESIGN FLOWS
25-YR FLOW (66.3) WILL PRODUCE WSE OF 55.20 → SET BOTTOM @ 54.10
100 EVENT → RISER CARRIES 38 CFS & WEIR CARRIES 54 CFS
BOTTOM WIDTH 14', $H_p = 1.4' \rightarrow Q = 59$ CFS

DIAMETER OF DEWATERING ORIFICE (6 HR DRAWDOWN; MIN 3" Ø ORIFICE)

DRY STORAGE = 84,483 C.F.

$Q = 84,483 / 6(3600) = 3.91$ CFS $h = 53.10 - 50.75 = 2.35'$

$A = \frac{Q}{[2.9 h/2]^{1/2} C_f} = \frac{3.91}{.6 [64.32 \times 2.35/2]^{1/2}} = 0.750$ S.F.

DIAMETER = $2(A/\pi)^{1/2} = .98' = 11.7"$

\therefore HOLD 11" ORIFICE & 12" Ø TUBE

PROJECT NAME: ROUTE 199

DEPARTMENT: CIVIL

PROJECT PART: DRAINAGE DESIGN

SHEET NO. _____ OF _____

SPEC. DIVISION: EROSION CONTROL & S.W.M.

COMPUTED BY: 12B DATE: 4/29/94

CHECKED BY: _____ DATE: _____

TEMPORARY SEDIMENT BASIN CALCULATIONS (CONTINUED..)

RISER SIZE

2-YR OUTFALL DESIGN $Q = 37.9$ CFS

USE 42" ϕ CMP RISER ; $H = 1.10'$ \rightarrow 25-YR WSE = $53.10 + 1.10 = 54.20$

BARREL SIZE

$H = 56.00 - 47.00 = 9.0'$; USE 36" CONC. EFFLUENT BARREL TO ACCOMMODATE 25-YR FLOW FROM PERMANENT STORM WATER MGMT FACILITY.

CONCENTRIC TRASH RACK & ANTI-VORTEX DEVICE

42" RISER $\rightarrow 9.62 \phi$

60" CYLINDER $\rightarrow 10.01 \phi \rightarrow 10.01 > 9.62$ OK

HEIGHT: 19" GAGE 16 ; #8 REBAR; TOP THICKNESS = 12 g. FLAT

ANTI-SEEP COLLARS

$L_s = 38'$

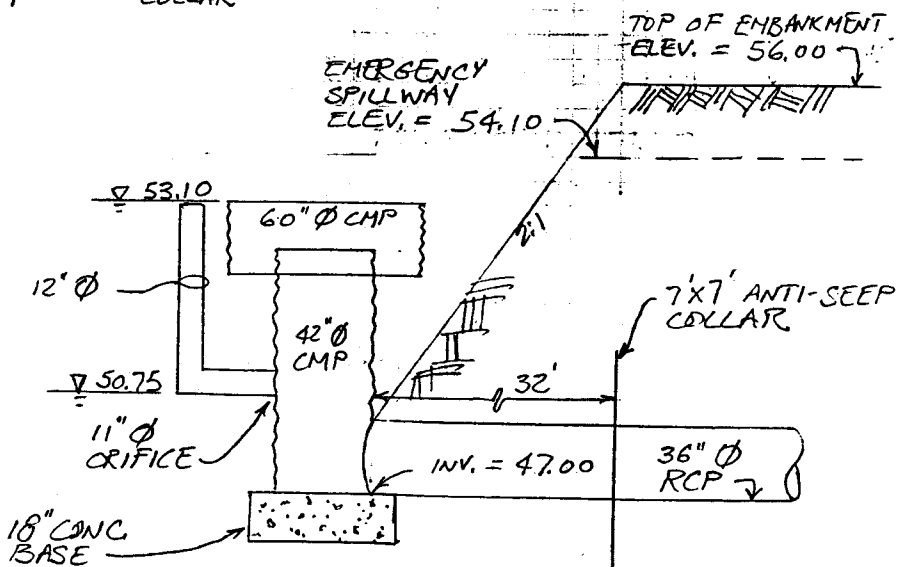
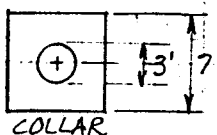
$Y = 53.10 - 47.00 = 6.10'$ $S = 0.0091$

USE ONE ANTI-SEEP COLLAR

COLLAR SIZE 7'x7'

$P = (7-3)/2 = 2'$

SET COLLAR 16P = 32'
FROM RISER



PROJECT NAME:

ROUTE 199

DEPARTMENT: CIVIL

PROJECT PART:

DRAINAGE DESIGN

SHEET NO: _____ OF _____

COMPUTED BY: 128

DATE: 4/29/94

SPEC. DIVISION:

EROSION CONTROL & S.W. M.

CHECKED BY: _____

DATE: _____

STORMWATER MANAGEMENT OUTFALL STRUCTURE CALCULATIONS

ORIFICE EQ. $Q = Cd A \sqrt{2gh}$; $Cd = 0.61$, $g = 32.16$

RECTANGULAR WEIR : $Q = 3.367 L H^{3/2}$

90° V-NOTCH WEIR : $Q = 2.54 h^{5/2}$

WATER QUALITY VOLUME (WQV) :

$1/2" (1/12) (22.32 \text{ AC.}) (43,560) = 40,511 \text{ C.F. RELEASED OVER 30 HRS.}$

$Q = 40,511 / 108,000 = 0.375 \text{ CFS}$

WSE OF WQV = 49.40

$h_{\text{ORIFICE}} = 49.40 - 47.00 = 2.40'$

$A = \frac{375}{(64.32 \times 2.40)^{1/2} (.61)} = .049 \text{ S.F.}$

DIAMETER = $2(A/\pi)^{1/2} = .25' = 3" \phi \text{ ORIFICE}$

USE 3" ϕ ORIFICE

16-1 47'-36" CONC. PIPE

INV. (IN) = 47.00, (OUT) = 46.50

1 STD. ES-1 REQ'D

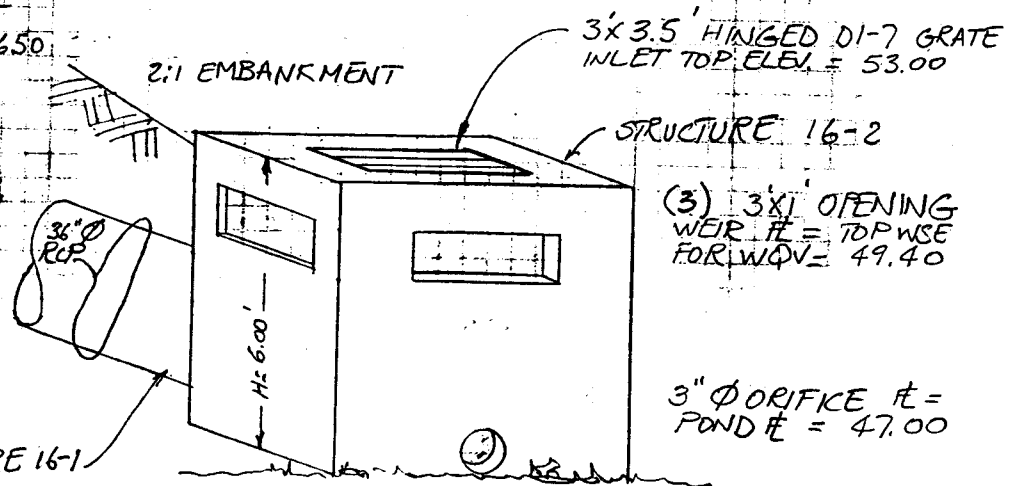
1 STD. EC-1 REQ'D

16-2 1 SPECIAL OUTLET STR.

H = 6.00'

SLOT INV. = 49.40

INV. = 47.00



Quick TR-55 Ver.5.46 S/N:
Executed: 22:37:19 02-12-1994

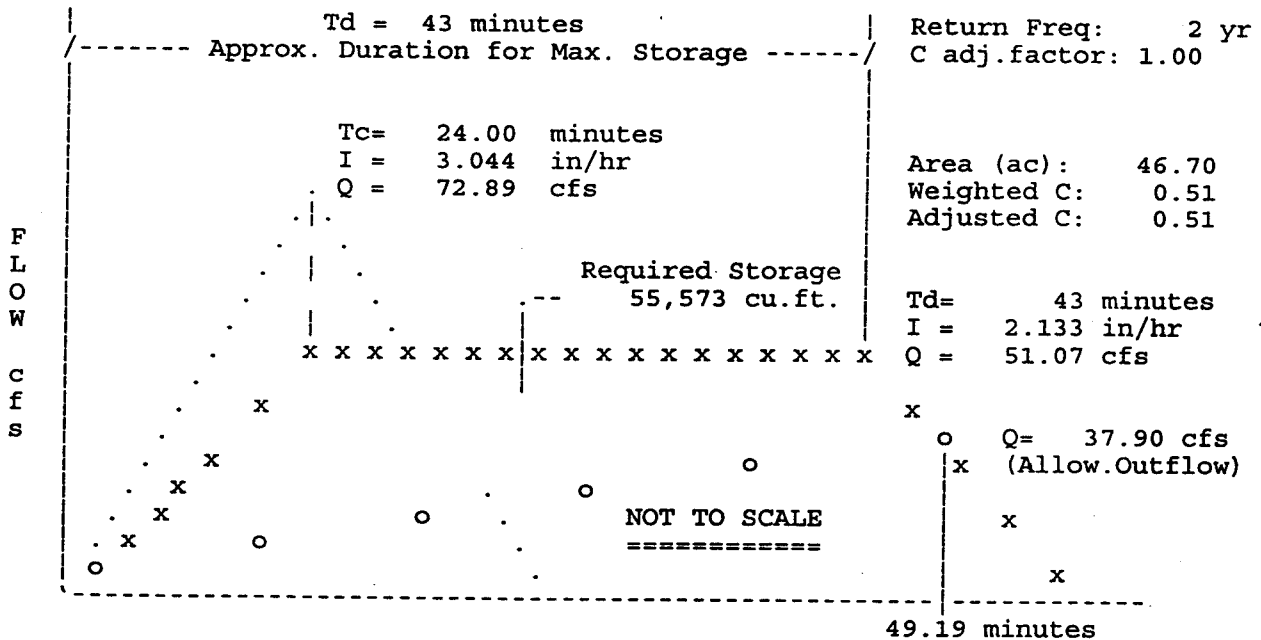
MODIFIED RATIONAL METHOD
---- Graphical Summary for Maximum Required Storage ----

First peak outflow point assumed to occur at inflow recession leg.

ROUTE 199 - AREA G
0199-047-F03-C501-RW204
S.W.M. POND RTE 199 STA. 285

* RETURN FREQUENCY: 2 yr | Allowable Outflow: 37.90 cfs *
* 'C' Adjustment: 1.000 | Required Storage: 55,573 cu.ft. *

* Peak Inflow: 51.07 cfs | Inflow .HYD stored: G-2 .HYD *



Quick TR-55 Ver.5.46 S/N:
Executed: 22:37:19 02-12-1994

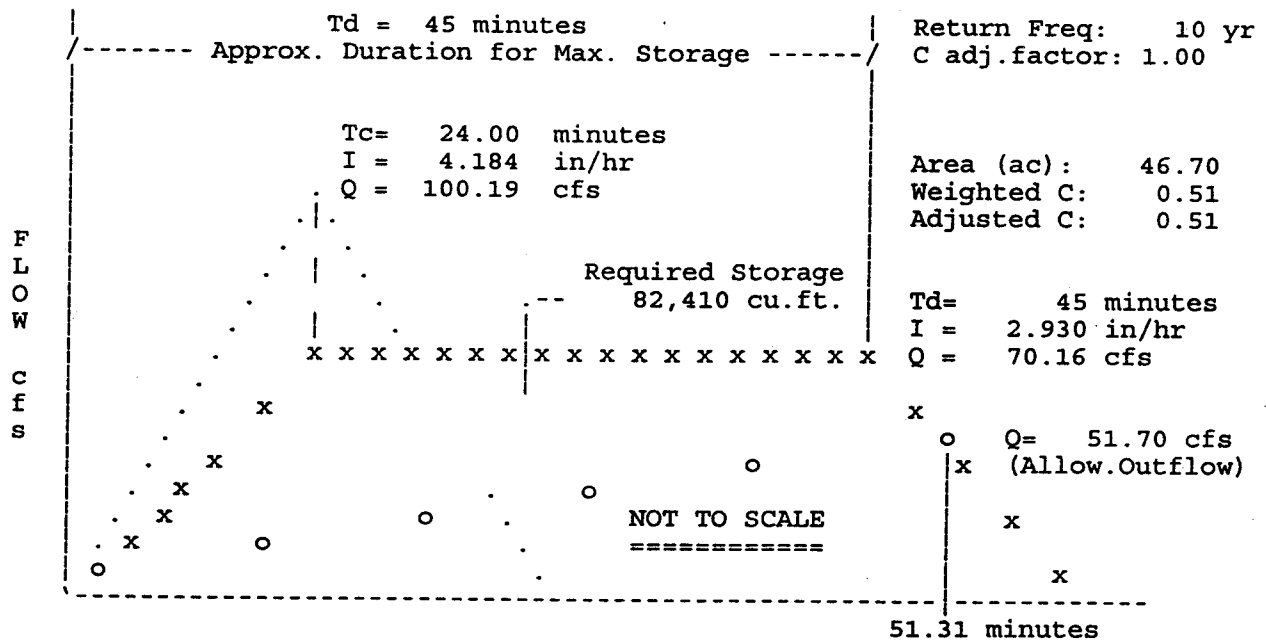
MODIFIED RATIONAL METHOD
---- Graphical Summary for Maximum Required Storage ----

First peak outflow point assumed to occur at inflow recession leg.

ROUTE 199 - AREA G
0199-047-F03-C501-RW204
S.W.M. POND RTE 199 STA. 285

* RETURN FREQUENCY: 10 yr | Allowable Outflow: 51.70 cfs *
* 'C' Adjustment: 1.000 | Required Storage: 82,410 cu.ft. *

* Peak Inflow: 70.16 cfs | Inflow .HYD stored: G-10 .HYD *



Quick TR-55 Ver.5.46 S/N:
Executed: 22:37:19 02-12-1994

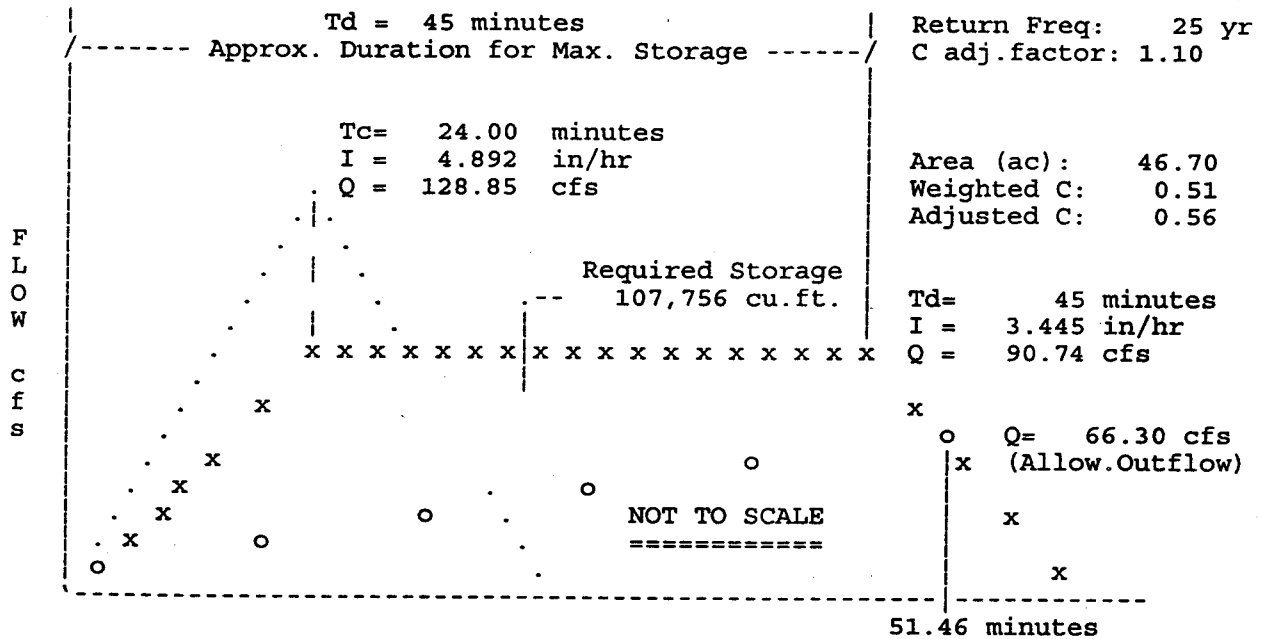
MODIFIED RATIONAL METHOD
---- Graphical Summary for Maximum Required Storage ----

First peak outflow point assumed to occur at inflow recession leg.

ROUTE 199 - AREA G
0199-047-F03-C501-RW204
S.W.M. POND RTE 199 STA. 285

* RETURN FREQUENCY: 25 yr | Allowable Outflow: 66.30 cfs *
* 'C' Adjustment: 1.100 | Required Storage: 107,756 cu.ft. *

* Peak Inflow: 90.74 cfs | Inflow .HYD stored: G-25 .HYD *



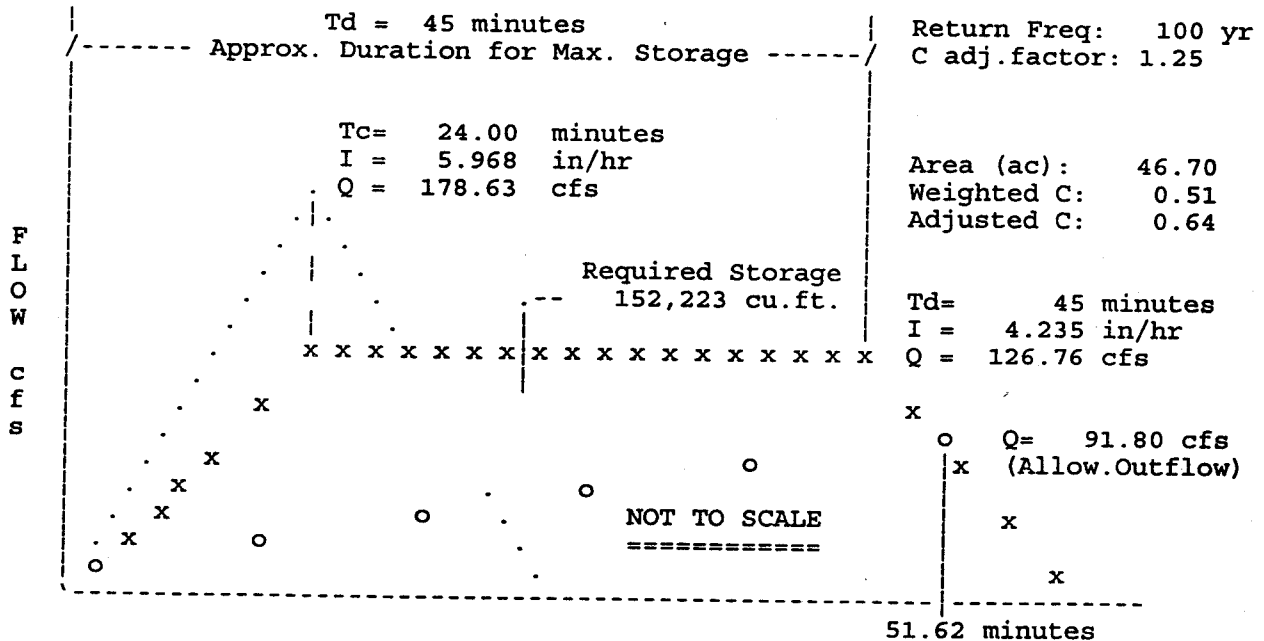
Quick TR-55 Ver.5.46 S/N:
Executed: 22:37:19 02-12-1994

MODIFIED RATIONAL METHOD
---- Graphical Summary for Maximum Required Storage ----

First peak outflow point assumed to occur at inflow recession leg.

ROUTE 199 - AREA G
0199-047-F03-C501-RW204
S.W.M. POND RTE 199 STA. 285

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*****
* RETURN FREQUENCY: 100 yr      Allowable Outflow: 91.80 cfs *
* 'C' Adjustment: 1.250        Required Storage: 152,223 cu.ft. *
*-----*
* Peak Inflow: 126.76 cfs      Inflow .HYD stored: G-100 .HYD *
*****
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Quick TR-55 Ver.5.46 S/N:
Executed: 22:37:19 02-12-1994

ROUTE 199 - AREA G
0199-047-F03-C501-RW204
S.W.M. POND RTE 199 STA. 285

**** Modified Rational Hydrograph ****
Weighted C = 0.513 Area= 46.700 acres Tc = 24.00 minutes
Adjusted C = 0.513 Td= 43.00 min. I= 2.13 in/hr Qp= 51.07 cfs
RETURN FREQUENCY: 2 year storm Adj.factor = 1.00
Output file: G-2 .HYD

HYDROGRAPH FOR MAXIMUM STORAGE
For the 2 Year Storm

Time Minutes	Time increment = 5.00 Minutes						
	Time on left represents time for first Q in each row.						
4.00	8.51	19.15	29.79	40.43	51.07	51.07	51.07
39.00	51.07	48.94	38.30	27.66	17.02	6.38	0.00

Quick TR-55 Ver.5.46 S/N:
Executed: 22:37:19 02-12-1994

ROUTE 199 - AREA G
0199-047-F03-C501-RW204
S.W.M. POND RTE 199 STA. 285

**** Modified Rational Hydrograph ****
Weighted C = 0.513 Area= 46.700 acres Tc = 24.00 minutes
Adjusted C = 0.513 Td= 45.00 min. I= 2.93 in/hr Qp= 70.16 cfs
RETURN FREQUENCY: 10 year storm Adj.factor = 1.00
Output file: G-10 .HYD

HYDROGRAPH FOR MAXIMUM STORAGE
For the 10 Year Storm

Time Minutes	Time increment = 5.00 Minutes						
	Time on left represents time for first Q in each row.						
4.00	11.69	26.31	40.93	55.54	70.16	70.16	70.16
39.00	70.16	70.16	58.47	43.85	29.23	14.62	0.00

Quick TR-55 Ver.5.46 S/N:
Executed: 22:37:19 02-12-1994

ROUTE 199 - AREA G
0199-047-F03-C501-RW204
S.W.M. POND RTE 199 STA. 285

**** Modified Rational Hydrograph ****
Weighted C = 0.513 Area= 46.700 acres Tc = 24.00 minutes
Adjusted C = 0.564 Td= 45.00 min. I= 3.44 in/hr Qp= 90.74 cfs
RETURN FREQUENCY: 25 year storm Adj.factor = 1.10
Output file: G-25 .HYD

HYDROGRAPH FOR MAXIMUM STORAGE
For the 25 Year Storm

Time Minutes	Time increment = 5.00 Minutes Time on left represents time for first Q in each row.						
4.00	15.12	34.03	52.93	71.84	90.74	90.74	90.74
39.00	90.74	90.74	75.62	56.71	37.81	18.90	0.00

Quick TR-55 Ver.5.46 S/N:
Executed: 22:37:19 02-12-1994

ROUTE 199 - AREA G
0199-047-F03-C501-RW204
S.W.M. POND RTE 199 STA. 285

**** Modified Rational Hydrograph ****
Weighted C = 0.513 Area= 46.700 acres Tc = 24.00 minutes
Adjusted C = 0.641 Td= 45.00 min. I= 4.23 in/hr Qp= 126.76 cfs
RETURN FREQUENCY: 100 year storm Adj.factor = 1.25
Output file: G-100 .HYD

HYDROGRAPH FOR MAXIMUM STORAGE
For the 100 Year Storm

Time Minutes	Time increment = 5.00 Minutes						
	Time on left represents time for first Q in each row.						
4.00	21.13	47.53	73.94	100.35	126.76	126.76	126.76
39.00	126.76	126.76	105.63	79.22	52.82	26.41	0.00

Quick TR-55 Ver.5.46 S/N:
 Executed: 22:37:19 02-12-1994

ROUTE 199 - AREA G
 0199-047-F03-C501-RW204
 S.W.M. POND RTE 199 STA. 285

* * * * * SUMMARY OF RATIONAL METHOD PEAK DISCHARGES * * * * *

$$Q = \text{adj} * C * I * A$$

Where: Q=cfs, C=Weighted Runoff Coefficient, I=in/hour, A=acres
 adj = 'C' adjustment factor for each return frequency

RETURN FREQUENCY = 2 years
 'C' adjustment, k = 1
 Adj. 'C' = Wtd.'C' x 1

Subarea Descr.	Runoff 'C'	Area acres	Tc (min)	Wtd. 'C'	Adj. 'C'	I in/hr	Total acres	Peak Q (cfs)
GRASS	0.350	31.87						
PAVED	0.900	13.24						
DEVELOPED	0.550	1.59						
			24.00	0.513	0.513	3.044	46.70	72.89

Quick TR-55 Ver.5.46 S/N:
 Executed: 22:37:19 02-12-1994

ROUTE 199 - AREA G
 0199-047-F03-C501-RW204
 S.W.M. POND RTE 199 STA. 285

* * * * * SUMMARY OF RATIONAL METHOD PEAK DISCHARGES * * * * *

$$Q = \text{adj} * C * I * A$$

Where: Q=cfs, C=Weighted Runoff Coefficient, I=in/hour, A=acres
 adj = 'C' adjustment factor for each return frequency

RETURN FREQUENCY = 10 years
 'C' adjustment, k = 1
 Adj. 'C' = Wtd. 'C' x 1

Subarea Descr.	Runoff 'C'	Area acres	Tc (min)	Wtd. 'C'	Adj. 'C'	I in/hr	Total acres	Peak Q (cfs)
GRASS	0.350	31.87						
PAVED	0.900	13.24						
DEVELOPED	0.550	1.59						
			24.00	0.513	0.513	4.184	46.70	100.19

Quick TR-55 Ver.5.46 S/N:
 Executed: 22:37:19 02-12-1994

ROUTE 199 - AREA G
 0199-047-F03-C501-RW204
 S.W.M. POND RTE 199 STA. 285

* * * * * SUMMARY OF RATIONAL METHOD PEAK DISCHARGES * * * * *

$$Q = \text{adj} * C * I * A$$

Where: Q=cfs, C=Weighted Runoff Coefficient, I=in/hour, A=acres
 adj = 'C' adjustment factor for each return frequency

RETURN FREQUENCY = 25 years
 'C' adjustment, k = 1.1
 Adj. 'C' = Wtd.'C' x 1.1

Subarea Descr.	Runoff 'C'	Area acres	Tc (min)	Wtd. 'C'	Adj. 'C'	I in/hr	Total acres	Peak Q (cfs)
GRASS	0.350	31.87						
PAVED	0.900	13.24						
DEVELOPED	0.550	1.59						
			24.00	0.513	0.564	4.892	46.70	128.85

Quick TR-55 Ver.5.46 S/N:
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ROUTE 199 - AREA G
 0199-047-F03-C501-RW204
 S.W.M. POND RTE 199 STA. 285

* * * * * SUMMARY OF RATIONAL METHOD PEAK DISCHARGES * * * * *

$$Q = \text{adj} * C * I * A$$

Where: Q=cfs, C=Weighted Runoff Coefficient, I=in/hour, A=acres
 adj = 'C' adjustment factor for each return frequency

RETURN FREQUENCY = 100 years
 'C' adjustment, k = 1.25
 Adj. 'C' = Wtd.'C' x 1.25

Subarea Descr.	Runoff 'C'	Area acres	Tc (min)	Wtd. 'C'	Adj. 'C'	I in/hr	Total acres	Peak Q (cfs)
GRASS	0.350	31.87						
PAVED	0.900	13.24						
DEVELOPED	0.550	1.59						
			24.00	0.513	0.641	5.968	46.70	178.63

Quick TR-55 Ver.5.46 S/N:
Executed: 22:37:19 02-12-1994

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*
*      MODIFIED RATIONAL METHOD
*    ---- Grand Summary For All Storm Frequencies ----
*
*
*****
*****

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First peak outflow point assumed to occur at inflow recession leg.

ROUTE 199 - AREA G
0199-047-F03-C501-RW204
S.W.M. POND RTE 199 STA. 285

Area = 46.70 acres

Tc = 24.00 minutes

						VOLUMES	
Frequency (years) (cu.ft.)	Adjusted 'C'	Duration minutes	Intens. in/hr	Qpeak cfs	Allowable cfs	Inflow (cu.ft.)	Storage
2	0.513	43	2.133	51.07	37.90	131,752	55,573
10	0.513	45	2.930	70.16	51.70	189,429	82,410
25	0.564	45	3.445	90.74	66.30	244,997	107,756
100	0.641	45	4.235	126.76	91.80	342,249	152,223

Quick TR-55 Ver.5.46 S/N:
 Executed: 22:37:19 02-12-1994

MODIFIED RATIONAL METHOD
 ---- Summary for Single Storm Frequency ----

First peak outflow point assumed to occur at inflow recession leg.

ROUTE 199 - AREA G
 0199-047-F03-C501-RW204
 S.W.M. POND RTE 199 STA. 285

RETURN FREQUENCY: 2 yr 'C' Adjustment = 1.000 Allowable Q = 37.90 cfs

Hydrograph file duration= 43.00 minutes

Hydrograph file: G-2 .HYD

Tc = 24.00 minutes

						VOLUMES	
Weighted 'C' (cu.ft.)	Adjusted 'C'	Duration minutes	Intens. in/hr	Areas acres	Qpeak cfs	Inflow (cu.ft.)	Storage
0.513	0.513	24	3.044	46.70	72.89	104,960	50,384
0.513	0.513	30	2.540	46.70	60.82	109,477	48,079
0.513	0.513	40	2.227	46.70	53.32	127,962	55,194
*****						Storage Maximum	
0.513	0.513	43	2.133	46.70	51.07	131,752	55,573

0.513	0.513	50	1.913	46.70	45.81	137,444	53,306
0.513	0.513	60	1.600	46.70	38.31	137,923	42,415
0.513	0.513	120	1.030	46.70	24.66	Qpeak < Qallow	

Quick TR-55 Ver.5.46 S/N:
Executed: 22:37:19 02-12-1994

MODIFIED RATIONAL METHOD
---- Summary for Single Storm Frequency ----

First peak outflow point assumed to occur at inflow recession leg.

ROUTE 199 - AREA G
0199-047-F03-C501-RW204
S.W.M. POND RTE 199 STA. 285

RETURN FREQUENCY: 10 yr 'C' Adjustment = 1.000 Allowable Q = 51.70 cfs

Hydrograph file duration= 45.00 minutes

Hydrograph file: G-10 .HYD

Tc = 24.00 minutes

.....
VOLUMES
Weighted Adjusted Duration Intens. Areas Qpeak Inflow Storage
'C' 'C' minutes in/hr acres cfs (cu.ft.)
(cu.ft.)

0.513	0.513	24	4.184	46.70	100.19	144,268	69,820
0.513	0.513	30	3.560	46.70	85.24	153,440	69,686
0.513	0.513	40	3.140	46.70	75.19	180,450	81,186
***** Storage Maximum							
0.513	0.513	45	2.930	46.70	70.16	189,429	82,410

0.513	0.513	50	2.720	46.70	65.13	195,391	80,617
0.513	0.513	60	2.300	46.70	55.07	198,265	67,981
0.513	0.513	120	1.480	46.70	35.44	Qpeak < Qallow	

Quick TR-55 Ver.5.46 S/N:
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MODIFIED RATIONAL METHOD
 ---- Summary for Single Storm Frequency ----

First peak outflow point assumed to occur at inflow recession leg.

ROUTE 199 - AREA G
 0199-047-F03-C501-RW204
 S.W.M. POND RTE 199 STA. 285

RETURN FREQUENCY: 25 yr 'C' Adjustment = 1.100 Allowable Q = 66.30 cfs

Hydrograph file duration= 45.00 minutes

Hydrograph file: G-25 .HYD

Tc = 24.00 minutes

						VOLUMES	
Weighted 'C' (cu.ft.)	Adjusted 'C'	Duration minutes	Intens. in/hr	Areas acres	Qpeak cfs	Inflow (cu.ft.)	Storage
0.513	0.564	24	4.892	46.70	128.85	185,548	90,076
0.513	0.564	30	4.180	46.70	110.10	198,178	90,772
0.513	0.564	40	3.690	46.70	97.19	233,263	105,967
*****						Storage Maximum	
0.513	0.564	45	3.445	46.70	90.74	244,997	107,756

0.513	0.564	50	3.200	46.70	84.29	252,859	105,673
0.513	0.564	60	2.710	46.70	71.38	256,968	89,892
0.513	0.564	120	1.750	46.70	46.09	Qpeak < Qallow	

Quick TR-55 Ver.5.46 S/N:
Executed: 22:37:19 02-12-1994

MODIFIED RATIONAL METHOD
---- Summary for Single Storm Frequency ----

First peak outflow point assumed to occur at inflow recession leg.

ROUTE 199 - AREA G
0199-047-F03-C501-RW204
S.W.M. POND RTE 199 STA. 285

RETURN FREQUENCY: 100 yr 'C' Adjustment = 1.250 Allowable Q = 91.80 cfs

Hydrograph file duration= 45.00 minutes

Hydrograph file: G-100 .HYD

Tc = 24.00 minutes

.....
VOLUMES
Weighted Adjusted Duration Intens. Areas Qpeak Inflow Storage
'C' 'C' minutes in/hr acres cfs (cu.ft.)
(cu.ft.)

0.513	0.641	24	5.968	46.70	178.63	257,227	125,035
0.513	0.641	30	5.120	46.70	153.25	275,846	127,130
0.513	0.641	40	4.530	46.70	135.59	325,413	149,157
***** Storage Maximum							
0.513	0.641	45	4.235	46.70	126.76	342,249	152,223

0.513	0.641	50	3.940	46.70	117.93	353,787	149,991
0.513	0.641	60	3.350	46.70	100.27	360,971	129,635
0.513	0.641	120	2.160	46.70	64.65	Qpeak < Qallow	

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*****
*
*      ROUTE 199 - AREA G
*      0199-047-F03-C501-RW204
*      S.W.M. POND RTE 199 STA. 285
*
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Inflow Hydrograph: C:\BANDAK\G-2 .HYD
 Rating Table file: C:\BANDAK\G-199 .PND

----INITIAL CONDITIONS----
 Elevation = 47.00 ft
 Outflow = 0.00 cfs
 Storage = 0 cu-ft

GIVEN POND DATA

ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (cu-ft)
47.00	0.0	0
47.50	0.0	533
48.00	0.0	4,765
48.50	0.0	14,157
49.00	0.0	27,613
49.50	1.0	43,524
50.00	14.1	59,800
50.50	30.1	76,452
51.00	46.2	93,492
51.50	55.0	110,919
52.00	63.8	128,734
52.50	70.7	146,935
53.00	77.5	165,521
53.50	99.6	184,493
54.00	121.6	203,849
54.50	135.5	223,612
55.00	152.8	243,803
55.50	170.4	264,424
56.00	190.1	285,473

INTERMEDIATE ROUTING COMPUTATIONS

2S/t (cfs)	2S/t + 0 (cfs)
0.0	0.0
3.6	3.6
31.8	31.8
94.4	94.4
184.1	184.1
290.2	291.2
398.7	412.8
509.7	539.8
623.3	669.5
739.5	794.5
858.3	922.1
979.6	1050.3
1103.5	1181.0
1230.0	1329.6
1359.0	1480.6
1490.8	1626.3
1625.4	1778.2
1762.9	1933.3
1903.2	2093.3

Time increment (t) = 5.0 min.

POND-2 Version: 5.17 S/N:
 EXECUTED: 02-12-1994 22:38:17

Page 2

Pond File: C:\BANDAK\G-199 .PND
 Inflow Hydrograph: C:\BANDAK\G-2 .HYD
 Outflow Hydrograph: C:\BANDAK\OUT .HYD

INFLOW HYDROGRAPH

ROUTING COMPUTATIONS

TIME (min)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
4.0	8.51	-----	0.0	0.0	0.00	47.00
9.0	19.15	27.7	27.7	27.7	0.00	47.93
14.0	29.79	48.9	76.6	76.6	0.00	48.36
19.0	40.43	70.2	146.8	146.8	0.00	48.79
24.0	51.07	91.5	237.3	238.3	0.51	49.25
29.0	51.07	102.1	327.0	339.4	6.20	49.70
34.0	51.07	102.1	396.9	429.2	16.17	50.06
39.0	51.07	102.1	449.1	499.0	24.96	50.34
44.0	48.94	100.0	486.6	549.1	31.25	50.54
49.0	38.30	87.2	505.2	573.8	34.32	50.63
54.0	27.66	66.0	503.2	571.1	33.99	50.62
59.0	17.02	44.7	485.6	547.8	31.10	50.53
64.0	6.38	23.4	456.6	509.0	26.23	50.38
69.0	0.00	6.4	422.1	463.0	20.42	50.20

***** SUMMARY OF ROUTING COMPUTATIONS *****

Pond File: C:\BANDAK\G-199 .PND
Inflow Hydrograph: C:\BANDAK\G-2 .HYD
Outflow Hydrograph: C:\BANDAK\OUT .HYD

Starting Pond W.S. Elevation = 47.00 ft

***** Summary of Peak Outflow and Peak Elevation *****

Peak Inflow	=	51.07 cfs
Peak Outflow	=	34.32 cfs
Peak Elevation	=	50.63 ft

***** Summary of Approximate Peak Storage *****

Initial Storage	=	0 cu-ft
Peak Storage From Storm	=	80,921 cu-ft

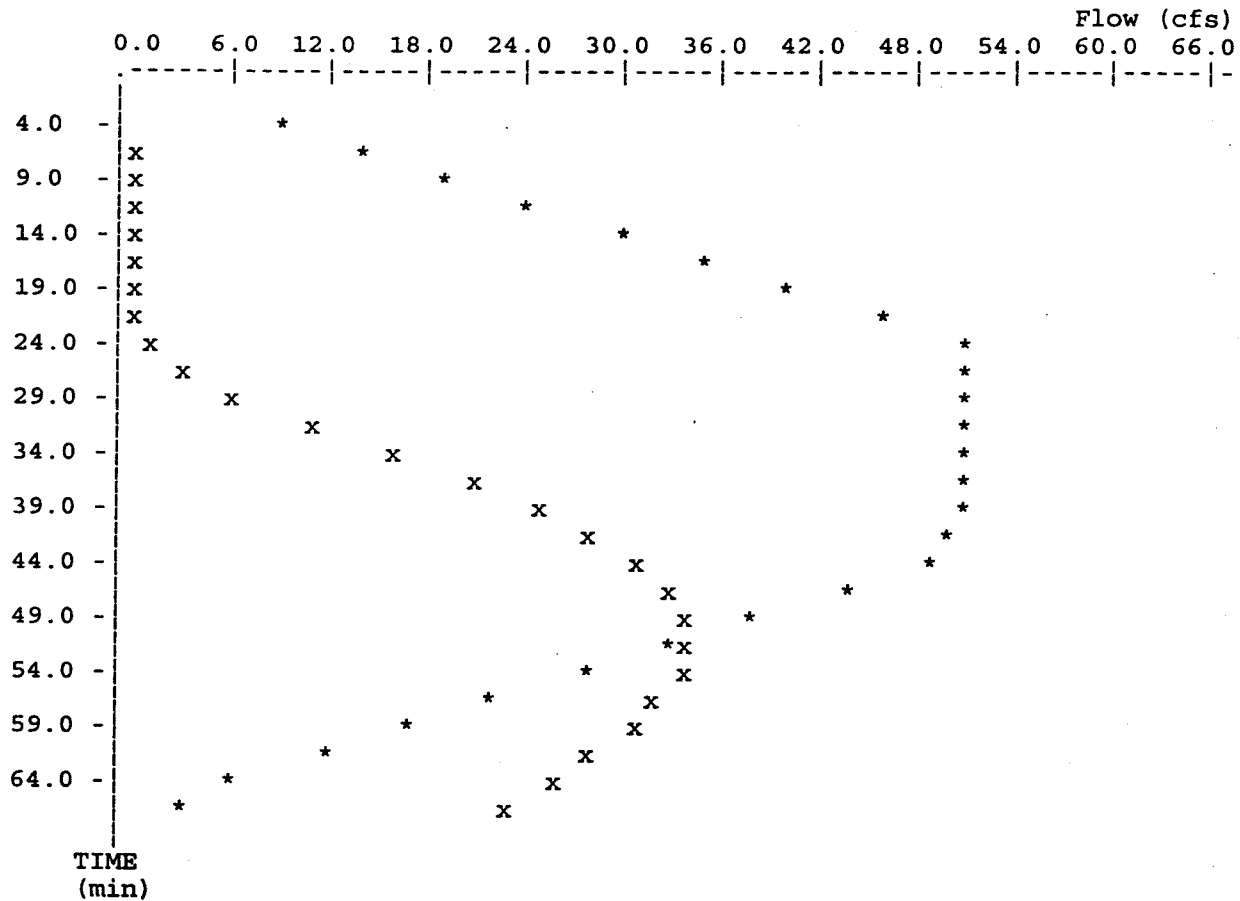
Total Storage in Pond	=	80,921 cu-ft

Warning: Inflow hydrograph truncated on left side.

Pond File: C:\BANDAK\G-199 .PND
 Inflow Hydrograph: C:\BANDAK\G-2 .HYD
 Outflow Hydrograph: C:\BANDAK\OUT .HYD

EXECUTED: 02-12-1994
 22:38:17

Peak Inflow = 51.07 cfs
 Peak Outflow = 34.32 cfs
 Peak Elevation = 50.63 ft



* File: C:\BANDAK\G-2 .HYD Qmax = 51.1 cfs
 x File: C:\BANDAK\OUT .HYD Qmax = 34.3 cfs

```

*****
*
*      ROUTE 199 - AREA G
*      0199-047-F03-C501-RW204
*      S.W.M. POND RTE 199 STA. 285
*
*****

```

Inflow Hydrograph: C:\BANDAK\G-10 .HYD
 Rating Table file: C:\BANDAK\G-199 .PND

----INITIAL CONDITIONS----
 Elevation = 47.00 ft
 Outflow = 0.00 cfs
 Storage = 0 cu-ft

GIVEN POND DATA			INTERMEDIATE ROUTING COMPUTATIONS	
ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (cu-ft)	2S/t (cfs)	2S/t + 0 (cfs)
47.00	0.0	0	0.0	0.0
47.50	0.0	533	3.6	3.6
48.00	0.0	4,765	31.8	31.8
48.50	0.0	14,157	94.4	94.4
49.00	0.0	27,613	184.1	184.1
49.50	1.0	43,524	290.2	291.2
50.00	14.1	59,800	398.7	412.8
50.50	30.1	76,452	509.7	539.8
51.00	46.2	93,492	623.3	669.5
51.50	55.0	110,919	739.5	794.5
52.00	63.8	128,734	858.3	922.1
52.50	70.7	146,935	979.6	1050.3
53.00	77.5	165,521	1103.5	1181.0
53.50	99.6	184,493	1230.0	1329.6
54.00	121.6	203,849	1359.0	1480.6
54.50	135.5	223,612	1490.8	1626.3
55.00	152.8	243,803	1625.4	1778.2
55.50	170.4	264,424	1762.9	1933.3
56.00	190.1	285,473	1903.2	2093.3

Time increment (t) = 5.0 min.

POND-2 Version: 5.17 S/N:
 EXECUTED: 02-12-1994 22:38:57

Page 2

Pond File: C:\BANDAK\G-199 .PND
 Inflow Hydrograph: C:\BANDAK\G-10 .HYD
 Outflow Hydrograph: C:\BANDAK\OUT .HYD

INFLOW HYDROGRAPH

ROUTING COMPUTATIONS

TIME (min)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - 0 (cfs)	2S/t + 0 (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
4.0	11.69	-----	0.0	0.0	0.00	47.00
9.0	26.31	38.0	38.0	38.0	0.00	48.05
14.0	40.93	67.2	105.2	105.2	0.00	48.56
19.0	55.54	96.5	201.4	201.7	0.16	49.08
24.0	70.16	125.7	317.3	327.1	4.87	49.65
29.0	70.16	140.3	418.2	457.7	19.75	50.18
34.0	70.16	140.3	493.6	558.5	32.42	50.57
39.0	70.16	140.3	550.4	634.0	41.79	50.86
44.0	70.16	140.3	595.3	690.7	47.69	51.08
49.0	58.47	128.6	623.9	723.9	50.03	51.22
54.0	43.85	102.3	625.8	726.2	50.19	51.23
59.0	29.23	73.1	602.4	698.9	48.27	51.12
64.0	14.62	43.9	559.6	646.2	43.31	50.91
69.0	0.00	14.6	505.5	574.2	34.37	50.63

***** SUMMARY OF ROUTING COMPUTATIONS *****

Pond File: C:\BANDAK\G-199 .PND
Inflow Hydrograph: C:\BANDAK\G-10 .HYD
Outflow Hydrograph: C:\BANDAK\OUT .HYD

Starting Pond W.S. Elevation = 47.00 ft

***** Summary of Peak Outflow and Peak Elevation *****

Peak Inflow	=	70.16 cfs
Peak Outflow	=	50.19 cfs
Peak Elevation	=	51.23 ft

***** Summary of Approximate Peak Storage *****

Initial Storage	=	0 cu-ft
Peak Storage From Storm	=	101,398 cu-ft

Total Storage in Pond	=	101,398 cu-ft

Warning: Inflow hydrograph truncated on left side.

Pond File: C:\BANDAK\G-199 .PND
Inflow Hydrograph: C:\BANDAK\G-10 .HYD
Outflow Hydrograph: C:\BANDAK\OUT .HYD

EXECUTED: 02-12-1994
22:38:57

Peak Inflow = 70.16 cfs
Peak Outflow = 50.19 cfs
Peak Elevation = 51.23 ft

Flow (cfs)
0.0 8.0 16.0 24.0 32.0 40.0 48.0 56.0 64.0 72.0 80.0 88.0
-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|
TIME
(min)

* File: C:\BANDAK\G-10 .HYD Qmax = 70.2 cfs
x File: C:\BANDAK\OUT .HYD Qmax = 50.2 cfs

```

*****
*
*          ROUTE 199 - AREA G
*      0199-047-F03-C501-RW204
*      S.W.M. POND RTE 199 STA. 285
*
*
*****
  
```

Inflow Hydrograph: C:\BANDAK\G-25 .HYD
 Rating Table file: C:\BANDAK\G-199 .PND

----INITIAL CONDITIONS----
 Elevation = 47.00 ft
 Outflow = 0.00 cfs
 Storage = 0 cu-ft

GIVEN POND DATA

ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (cu-ft)
47.00	0.0	0
47.50	0.0	533
48.00	0.0	4,765
48.50	0.0	14,157
49.00	0.0	27,613
49.50	1.0	43,524
50.00	14.1	59,800
50.50	30.1	76,452
51.00	46.2	93,492
51.50	55.0	110,919
52.00	63.8	128,734
52.50	70.7	146,935
53.00	77.5	165,521
53.50	99.6	184,493
54.00	121.6	203,849
54.50	135.5	223,612
55.00	152.8	243,803
55.50	170.4	264,424
56.00	190.1	285,473

INTERMEDIATE ROUTING
 COMPUTATIONS

2S/t (cfs)	2S/t + 0 (cfs)
0.0	0.0
3.6	3.6
31.8	31.8
94.4	94.4
184.1	184.1
290.2	291.2
398.7	412.8
509.7	539.8
623.3	669.5
739.5	794.5
858.3	922.1
979.6	1050.3
1103.5	1181.0
1230.0	1329.6
1359.0	1480.6
1490.8	1626.3
1625.4	1778.2
1762.9	1933.3
1903.2	2093.3

Time increment (t) = 5.0 min.

POND-2 Version: 5.17 S/N:
 EXECUTED: 02-12-1994 22:41:28

Page 2

Pond File: C:\BANDAK\G-199 .PND
 Inflow Hydrograph: C:\BANDAK\G-25 .HYD
 Outflow Hydrograph: C:\BANDAK\OUT .HYD

INFLOW HYDROGRAPH

ROUTING COMPUTATIONS

TIME (min)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - 0 (cfs)	2S/t + 0 (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
4.0	15.12	-----	0.0	0.0	0.00	47.00
9.0	34.03	49.2	49.2	49.2	0.00	48.14
14.0	52.93	87.0	136.1	136.1	0.00	48.73
19.0	71.84	124.8	259.4	260.9	0.72	49.36
24.0	90.74	162.6	391.5	422.0	15.26	50.04
29.0	90.74	181.5	504.5	573.0	34.22	50.63
34.0	90.74	181.5	591.3	686.0	47.36	51.07
39.0	90.74	181.5	665.8	772.8	53.47	51.41
44.0	90.74	181.5	730.0	847.3	58.64	51.71
49.0	75.62	166.4	772.3	896.4	62.03	51.90
54.0	56.71	132.3	779.5	904.7	62.60	51.93
59.0	37.81	94.5	753.0	874.0	60.48	51.81
64.0	18.90	56.7	697.6	809.7	56.05	51.56
69.0	0.00	18.9	617.5	716.5	49.51	51.19

***** SUMMARY OF ROUTING COMPUTATIONS *****

Pond File: C:\BANDAK\G-199 .PND
Inflow Hydrograph: C:\BANDAK\G-25 .HYD
Outflow Hydrograph: C:\BANDAK\OUT .HYD

Starting Pond W.S. Elevation = 47.00 ft

***** Summary of Peak Outflow and Peak Elevation *****

Peak Inflow	=	90.74 cfs
Peak Outflow	=	62.60 cfs
Peak Elevation	=	51.93 ft

***** Summary of Approximate Peak Storage *****

Initial Storage	=	0 cu-ft
Peak Storage From Storm	=	126,304 cu-ft

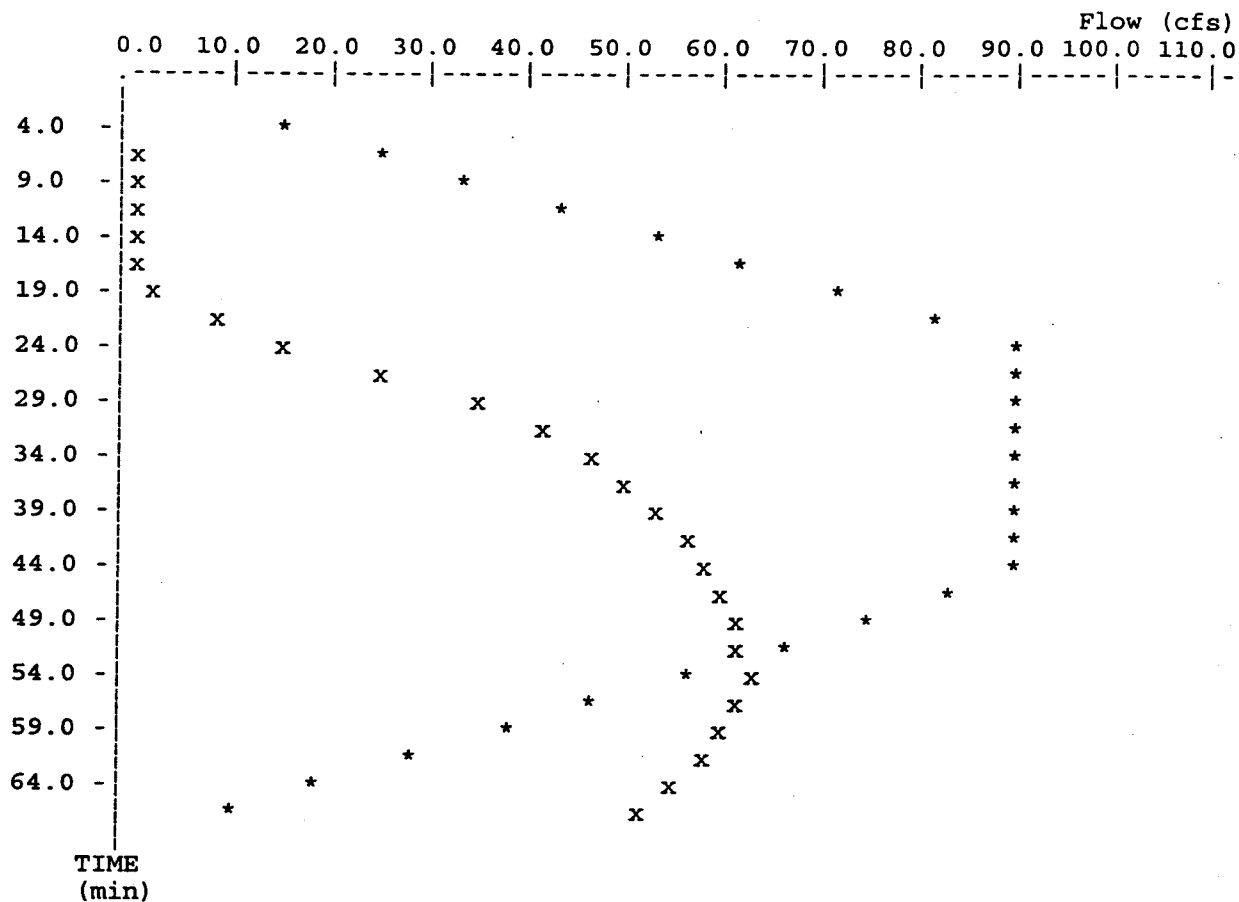
Total Storage in Pond	=	126,304 cu-ft

Warning: Inflow hydrograph truncated on left side.

Pond File: C:\BANDAK\G-199 .PND
 Inflow Hydrograph: C:\BANDAK\G-25 .HYD
 Outflow Hydrograph: C:\BANDAK\OUT .HYD

EXECUTED: 02-12-1994
 22:41:28

Peak Inflow = 90.74 cfs
 Peak Outflow = 62.60 cfs
 Peak Elevation = 51.93 ft



* File: C:\BANDAK\G-25 .HYD Qmax = 90.7 cfs
 x File: C:\BANDAK\OUT .HYD Qmax = 62.6 cfs

```

*****
*
*      ROUTE 199 - AREA G
*      0199-047-F03-C501-RW204
*      S.W.M. POND RTE 199 STA. 285
*
*****

```

Inflow Hydrograph: C:\BANDAK\G-100 .HYD
Rating Table file: C:\BANDAK\G-199 .PND

-----INITIAL CONDITIONS-----
Elevation = 47.00 ft
Outflow = 0.00 cfs
Storage = 0 cu-ft

GIVEN POND DATA			INTERMEDIATE ROUTING COMPUTATIONS	
ELEVATION (ft)	OUTFLOW (cfs)	STORAGE (cu-ft)	2S/t (cfs)	2S/t + 0 (cfs)
47.00	0.0	0	0.0	0.0
47.50	0.0	533	3.6	3.6
48.00	0.0	4,765	31.8	31.8
48.50	0.0	14,157	94.4	94.4
49.00	0.0	27,613	184.1	184.1
49.50	1.0	43,524	290.2	291.2
50.00	14.1	59,800	398.7	412.8
50.50	30.1	76,452	509.7	539.8
51.00	46.2	93,492	623.3	669.5
51.50	55.0	110,919	739.5	794.5
52.00	63.8	128,734	858.3	922.1
52.50	70.7	146,935	979.6	1050.3
53.00	77.5	165,521	1103.5	1181.0
53.50	99.6	184,493	1230.0	1329.6
54.00	121.6	203,849	1359.0	1480.6
54.50	135.5	223,612	1490.8	1626.3
55.00	152.8	243,803	1625.4	1778.2
55.50	170.4	264,424	1762.9	1933.3
56.00	190.1	285,473	1903.2	2093.3

Time increment (t) = 5.0 min.

POND-2 Version: 5.17 S/N:
 EXECUTED: 02-12-1994 22:42:20

Page 2

Pond File: C:\BANDAK\G-199 .PND
 Inflow Hydrograph: C:\BANDAK\G-100 .HYD
 Outflow Hydrograph: C:\BANDAK\OUT .HYD

INFLOW HYDROGRAPH

ROUTING COMPUTATIONS

TIME (min)	INFLOW (cfs)	I1+I2 (cfs)	2S/t - O (cfs)	2S/t + O (cfs)	OUTFLOW (cfs)	ELEVATION (ft)
4.0	21.13	-----	0.0	0.0	0.00	47.00
9.0	47.53	68.7	68.7	68.7	0.00	48.29
14.0	73.94	121.5	190.0	190.1	0.06	49.03
19.0	100.35	174.3	346.6	364.3	8.88	49.80
24.0	126.76	227.1	505.1	573.7	34.30	50.63
29.0	126.76	253.5	653.6	758.6	52.47	51.36
34.0	126.76	253.5	781.6	907.2	62.77	51.94
39.0	126.76	253.5	895.4	1035.1	69.88	52.44
44.0	126.76	253.5	997.2	1148.9	75.83	52.88
49.0	105.63	232.4	1060.2	1229.6	84.73	53.16
54.0	79.22	184.9	1071.0	1245.0	87.02	53.22
59.0	52.82	132.0	1041.5	1203.0	80.77	53.07
64.0	26.41	79.2	972.0	1120.7	74.36	52.77
69.0	0.00	26.4	862.6	998.4	67.91	52.30

***** SUMMARY OF ROUTING COMPUTATIONS *****

Pond File: C:\BANDAK\G-199 .PND
Inflow Hydrograph: C:\BANDAK\G-100 .HYD
Outflow Hydrograph: C:\BANDAK\OUT .HYD

Starting Pond W.S. Elevation = 47.00 ft

***** Summary of Peak Outflow and Peak Elevation *****

Peak Inflow	=	126.76 cfs
Peak Outflow	=	87.02 cfs
Peak Elevation	=	53.22 ft

***** Summary of Approximate Peak Storage *****

Initial Storage	=	0 cu-ft
Peak Storage From Storm	=	173,692 cu-ft

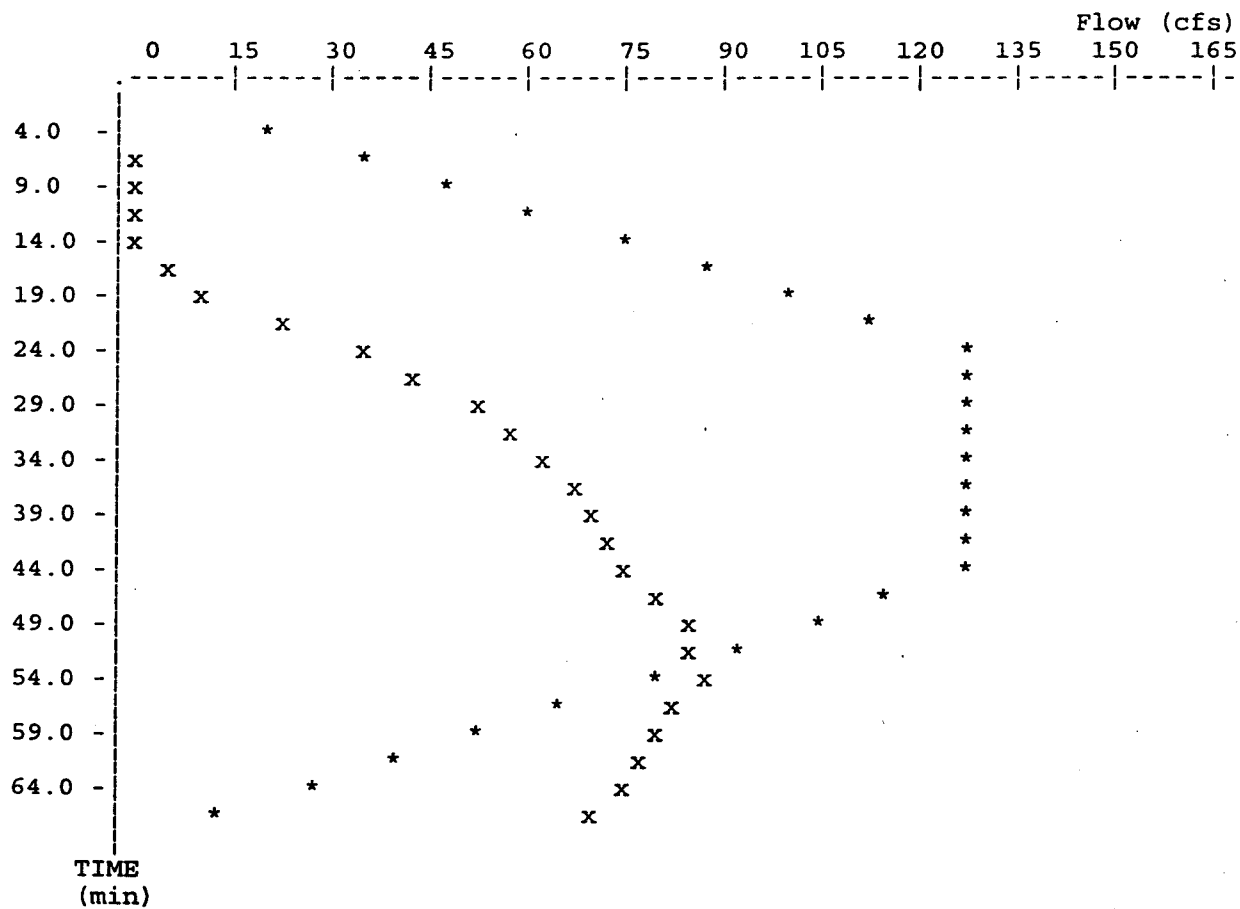
Total Storage in Pond	=	173,692 cu-ft

Warning: Inflow hydrograph truncated on left side.

Pond File: C:\BANDAK\G-199 .PND
 Inflow Hydrograph: C:\BANDAK\G-100 .HYD
 Outflow Hydrograph: C:\BANDAK\OUT .HYD

EXECUTED: 02-12-1994
 22:42:20

Peak Inflow = 126.76 cfs
 Peak Outflow = 87.02 cfs
 Peak Elevation = 53.22 ft



* File: C:\BANDAK\G-100 .HYD Qmax = 126.8 cfs
 x File: C:\BANDAK\OUT .HYD Qmax = 87.0 cfs

CERTIFICATION INFO

WILLIAMSBURG PLANTATION

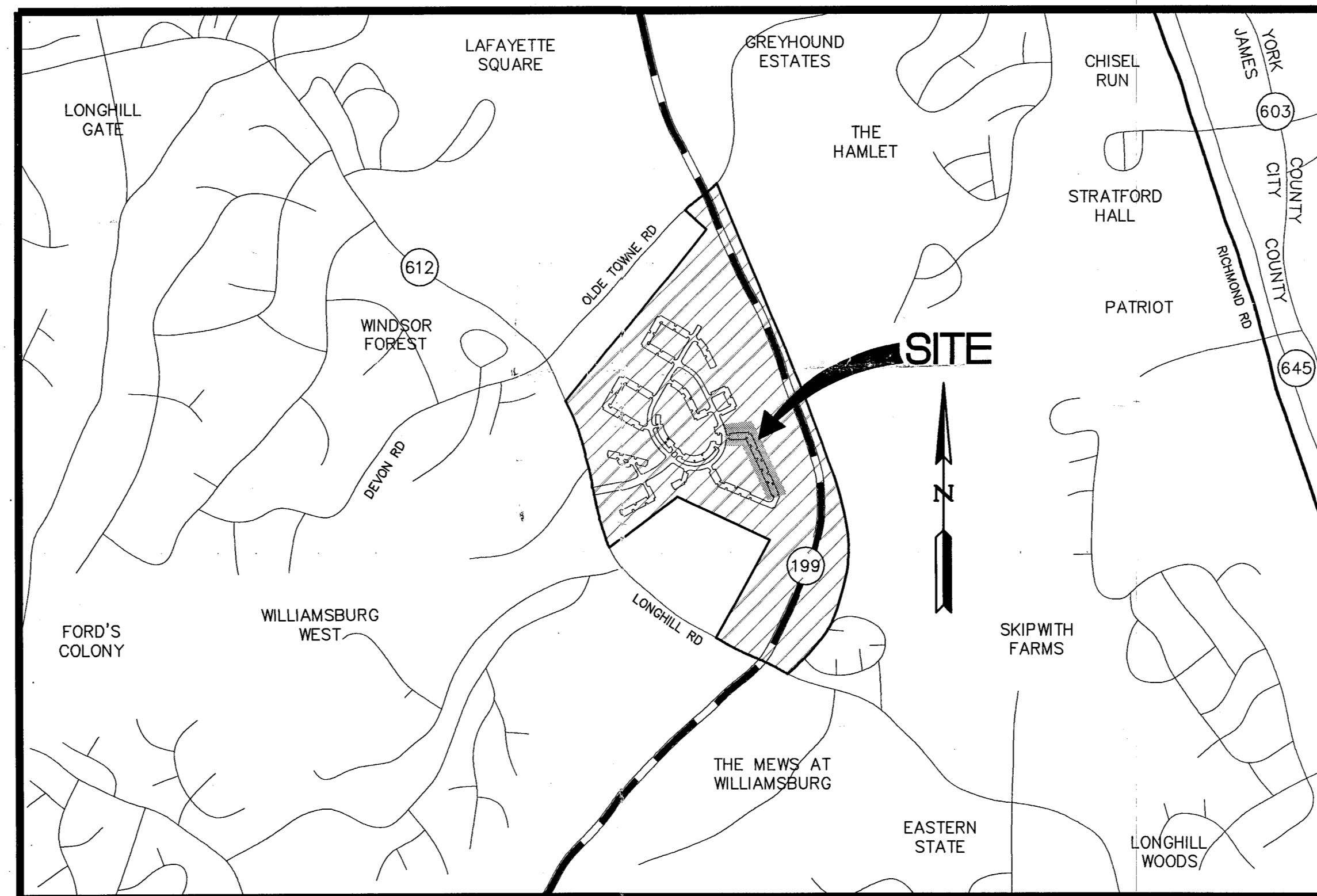
SECTION 5: UNITS 97-133

FOR

WILLIAMSBURG PLANTATION, INC.

GENERAL NOTES

1. PROPERTY ZONING: LIMITED RESIDENTIAL DISTRICT R-2.
2. PROPERTY TAX PARCEL NO.: PART OF (32-4) (1-26C)
3. PROPERTY ADDRESS: 4870 LONGHILL ROAD
4. THIS SITE PLAN IS FOR A SECTION OF TIMESHARE UNITS WHICH IS PART OF AN APPROVED OVERALL CLUSTER DEVELOPMENT PLAN (JCC CASE NO. MP-02-00).
5. THE UNITS ARE 2 STORIES, USE GROUP B, AND CONSTRUCTION TYPE 3B. MAXIMUM BUILDING HEIGHT IS 35 FEET.
6. OVERALL SITE DENSITY IS 3.99 UNITS/ACRE AS APPROVED WITH AMENDED MASTER PLAN MP-02-00. TOTAL APPROVED UNITS TO DATE = 96 UNITS.
7. ALL UTILITIES SHALL BE PLACED UNDERGROUND AND SHALL HAVE A MINIMUM OF 36" OF COVER.
8. THE CONTRACTOR SHALL SATISFY HIMSELF AS TO ALL SITE CONDITIONS PRIOR TO CONSTRUCTION. CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND SHALL NOTIFY MISS UTILITY (1-800-552-7001) PRIOR TO ANY EXCAVATION OR DEMOLITION.
9. VERIFY ALL DIMENSIONS AND NOTIFY JAMES CITY SERVICE AUTHORITY PRIOR TO ANY EXCAVATION OR DEMOLITION WITHIN UTILITY CORRIDORS.
10. THE CONTRACTOR IS RESPONSIBLE FOR OBTAINING ALL NECESSARY PERMITS PRIOR TO COMMENCEMENT OF WORK, TO INCLUDE, BUT NOT LIMITED TO, JAMES CITY COUNTY LAND DISTURBANCE, BUILDING, AND UTILITY.
11. A LAND DISTURBING PERMIT AND SILTATION AGREEMENT, WITH SURETY, ARE REQUIRED FOR THIS PROJECT.
12. CONTRACTOR SHALL BE RESPONSIBLE FOR THE COORDINATION OF CONSTRUCTION EFFORTS WITH VIRGINIA NATURAL GAS, VIRGINIA POWER, APPROPRIATE TELEPHONE COMPANY, APPROPRIATE CABLE COMPANY, JAMES CITY SERVICE AUTHORITY, AND OTHERS THAT MAY BE REQUIRED.
13. PROJECT TO BE SERVED BY PUBLIC WATER AND SEWER OWNED BY THE JAMES CITY SERVICE AUTHORITY. ALL PROPOSED WATER AND SANITARY IMPROVEMENTS TO BE CONSTRUCTED IN ACCORDANCE WITH JCSA STANDARDS AND SPECIFICATIONS.
14. ALL PARKING SPACES SHALL BE DELINEATED WITH PAINT STRIPING. THE MINIMUM NUMBER OF PARKING SPACES SHALL BE 2.5 PER DWELLING UNIT, IN ACCORDANCE WITH SEC. 24-59 (A) (1) OF THE JCC ZONING ORDINANCE. HANDICAP PARKING SPACES SHALL BE DESIGNATED BY ABOVE GROUND SIGNS PER USBC REQUIREMENTS.
15. REFUSE TO BE REMOVED BY PRIVATE CONTRACTOR.
16. THE SITE DOES NOT LIE WITHIN ANY RESOURCE PROTECTION AREAS.
17. THIS PROPERTY LIES IN ZONE "X" (AREAS DETERMINED TO BE OUTSIDE THE 500 YEAR FLOOD PLAIN) AS SHOWN ON COMMUNITY PANEL #510201 0035 B, DATED 2/6/ 1991 OF THE FLOOD INSURANCE RATE MAPS FOR JAMES CITY COUNTY, VIRGINIA.
18. CONTOUR INTERVAL IS ONE FOOT.
19. ANY NEW SIGNS SHALL BE IN ACCORDANCE WITH ARTICLE II, DIVISION 3 OF THE JCC ZONING ORDINANCE.
20. ANY OLD WELLS THAT MAY BE ON-SITE THAT WILL NOT BE USED MUST BE PROPERLY ABANDONED ACCORDING TO STATE PRIVATE WELL REGULATIONS AND JAMES CITY COUNTY CODE.
21. OWNER/ DEVELOPER: THE BERKELEY GROUP
MR. J.P. OTTING, III
BERKELEY SOUTH BLDG, EXEC. SUITE 115
3015 N. OCEAN BLVD
FT. LAUDERDALE, FL 33308

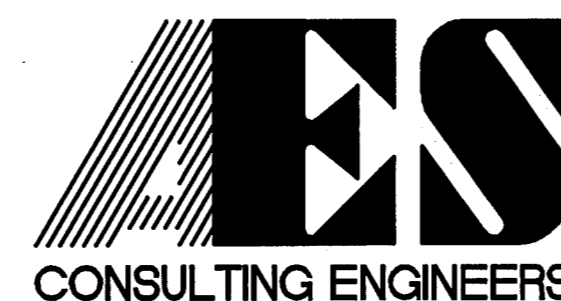


VICINITY MAP (APPROX. SCALE 1"=1000')

DATE: AUGUST 23, 2000
REVISED: NOVEMBER 16, 2000
PROJECT NO.: 7555-12

INDEX OF SHEETS

SHEET NUMBER	DESCRIPTION
1	COVER SHEET
2	SITE AND UTILITY PLAN/GRADING, DRAINAGE AND E&S PLAN (PHASE I)
2A	UTILITY PROFILES, NOTES AND DETAILS (PHASE I)
3	SITE PLAN (PHASE II)
3A	INTERIM GRADING, EROSION AND SEDIMENT CONTROL PLAN (PHASE II)
3B	GRADING, EROSION AND SEDIMENT CONTROL PLAN (PHASE II)
4	DRAINAGE AND UTILITY PLAN
5	UTILITY PROFILES
6	LANDSCAPE PLAN AND DETAILS
7	LIGHTING PLAN AND DETAILS
8	ENVIRONMENTAL INVENTORY
9	NOTES AND DETAILS
10	NOTES AND DETAILS
11	SMP (VDOT FACILITY "G") NOTES AND DETAILS



5248 Olde Towne Road, Suite 1
Williamsburg, Virginia 23188
(757) 253-0040
Fax (757) 220-8994

RECORD DRAWING BASED ON INFORMATION AS
SURVEYED 5-02 & 3-04 BY A.E.S. CONSULTING
ENGINEERS

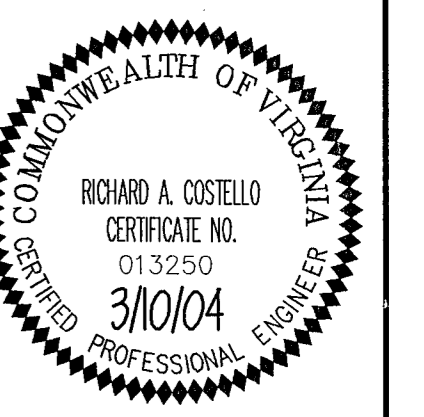
EXISTING	PROPOSED	EXISTING	PROPOSED
WATER	W	EXISTING TREELINE	
SANITARY SEWER	S	EXISTING TREE	
FORCE MAIN	FM	LIMITS OF CLEARING	
OVERHEAD TELEPHONE LINE	O/H TELE	SILT FENCE	
UNDERGROUND PHONE LINE	PHONE	WIRE REINFORCED SILT FENCE	
OVERHEAD ELECTRIC LINE	O/E	INLET PROTECTION	
GAS LINE	G	CHECK DAM	
FIBER OPTIC	FO	STRAW BALE BARRIER	
OVERHEAD CABLE		DIVERSION DIKE	
MANHOLE		RIP RAP	
CURB DROP INLET		REVERSE GRADE OUTER PAN	
YARD DROP INLET		BORING	
FLARED END SECTION		BENCH MARK	
VALVE		GROUND ELEVATION	
FIRE HYDRANT ASSEMBLY		TOP OF CURB ELEV.	
BLOW-OFF VALVE		FINISH GRADE ELEV.	
AIR RELEASE ASSEMBLY		TOP OF WALL ELEV.	
CLEAN OUT		GRADING LINE TIE-IN	
WATER METER		EXISTING CONTOUR ELEV.	
POWER POLE		CONTOUR ELEV.	
POWER POLE W/GUY WIRE		GRADING BY OTHERS	
LIGHT POLE		RESERVED PARKING	
STREETLIGHT		YARD HYDRANT	
CENTERLINE/BASELINE		MAILBOX	
RIGHT OF WAY		SIGN	
PROPERTY LINE		WETLANDS	
DITCH/SWALE		RPA BUFFER	
CONCRETE LINED DITCH			
EC-3 LINED DITCH			
BITUMINOUS CONCRETE			
CONCRETE			
AGGREGATE/GRAVEL			

APPROVED
James City County
Environmental Officer
By: [Signature]
Date: 3/10/04

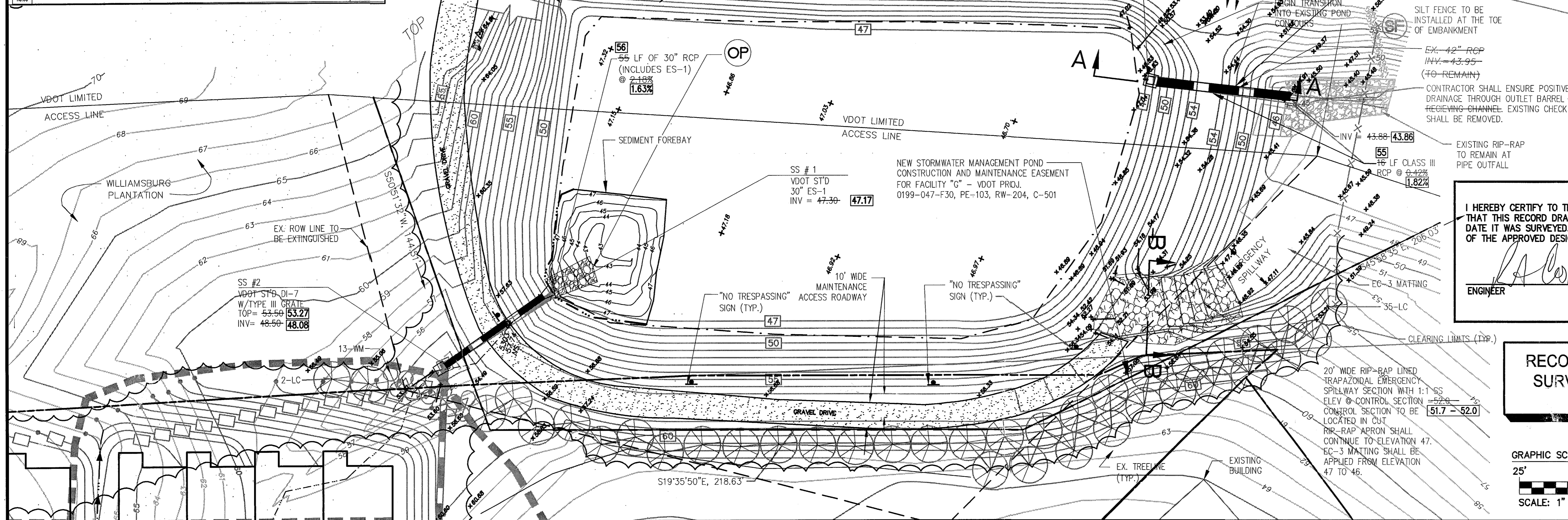
I HEREBY CERTIFY TO THE BEST OF MY JUDGEMENT, KNOWLEDGE, AND BELIEF THAT THIS
RECORD DRAWING REPRESENTS THE CONDITIONS OF THE SITE ON THE DATE IT WAS
SURVEYED. THE SITE APPEARS TO CONFORM WITH THE PROVISIONS OF THE APPROVED
DESIGN PLAN.

[Signature]
ENGINEER

DATE 3/10/04



No.	DATE	REVISION / COMMENT / NOTE	BY
7	3/10/04	RECORD DRAWING STORM WATER MANAGEMENT/ BMP FACILITY	CBR
6	3/27/03	RECORD DRAWING STORM WATER MANAGEMENT/ BMP FACILITY	CBR
5	5/4/01	REVISED PER JCSA COMMENTS DATED 5/4/01	CBR
4	4/17/01	REVISED PER JCC ENVIR. COMMENTS AND TO INDICATE PHASING	CBR
3	3/23/01	REVISED PER VDOT COMMENTS (DRY POND) FACILITY "G"	CBR
2	11/16/00	REVISED PER JCSA COMMENTS	CBR
1	10/18/00	REVISED SITE LAYOUT & REVISIONS PER JCC COMMENTS	CBR



Designed by HPW/CBR	Drawn RMK
Scale AS NOTED	Date 8/23/00
Project No. 7555-12	
Drawing No. 11	